SENSOR3®

Sensor3 Rack (SR3 and HSR3 Series) Installation Manual

Revision C

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Introduction

Welcome to the installation manual for Sensor®3 racks. This manual contains the procedures for safe and efficient installation of individual and bussed Sensor3 SR3 and HSR3 series dimming systems. SR3 series racks are designed for 120V phase to neutral and are sold in North America. HSR3 racks are designed for 240V phase to neutral and are sold in South America, Asia and the Pacific Rim. There are four sizes of installation racks:

UL File# E92134

- SR3-6 (120V only) – Six dimmer slots (up to 12 circuits)
- SR3-12 and HSR3-12 – Twelve dimmer slots (up to 24 circuits)
- SR3-24 and HSR3-24 – Twenty-four dimmer slots (up to 48 circuits)
- SR3-48 and HSR3-48 – Forty-eight dimmer slots (up to 96 circuits)

SR3-6 racks cannot be bussed, while the 12, 24, and 48 module racks listed above can be bussed. A bussed SR3-24 or SR3-48 installation may also include an Auxiliary Bay equipped with main circuit breakers.

How To Use This Guide

Use this guide during system installation. It contains complete installation instructions.

- *Introduction, page 1,* describes general requirements for installation.
- *Installation of Individual Racks, page 6,* contains procedures for installing your rack.
- *Installation of Bussed Racks, page 15,* contains procedures for installing your bussed rack.
- *Finishing Installation, page 40*, contains sealing the rack and installing the rack door.
- When viewing this document in electronic form (PDF file) with Adobe Acrobat Reader, blue italicized text followed by a page number such as "*How To Use This Guide, page 1*" is a link within the document. If you click on the link, it will jump to that section or topic.

Warnings and Notice Conventions

These symbols are used in Sensor3 documentation to alert you to danger or important information:

Note: *Notes are helpful hints and information that is supplemental to the main text.*

CAUTION: *A Caution statement indicates situations where there may be undefined or unwanted consequences of an action, potential for data loss or an equipment problem.*

WARNING: ***A Warning statement indicates situations where damage may occur, people may be harmed, or there are serious or dangerous consequences of an action.***

WARNING: ***RISK OF ELECTRIC SHOCK! This warning statement indicates situations where there is a risk of electric shock.***

Contacting ETC

For questions about Sensor3 rack system delivery, contact ETC Systems Group.

For general information/technical questions about Sensor3 rack systems, contact ETC Technical Services.

Americas	Europe	Asia
ETC International	ETC Europe Ltd.	ETC Asia Ltd.
Technical Services Department	Technical Services Department	Technical Services Department
3031 Pleasant View Road	Unit 5 Victoria Industrial Estate	Room 605-606
Middleton, WI 53562	Victoria Road	Tower III, Enterprise Square
800-775-4382 (USA,toll-free)	London W3 6UU England	9 Sheung Yuet Road
		Kowloon Bay, Kowloon, Hong Kong
+1 608 831 4116	+44 (0)20 8896 1000	+852 2799 1220
service@etcconnect.com	service@etceurope.com	service@etcasia.com

Please email comments about this manual to: **TechComm@etcconnect.com**

Chapter 1
Prepare for Installation

Unpack and Inspect

Before you begin installation, check your shipment and confirm it arrived complete and undamaged.

Step 1: Check the shipping container for physical damage.

Step 2: If you find damage, document it to help with a claim against your shipper.

Step 3: Unpack your order and check the contents against the packing list to be sure your order is complete.

Step 4: If you discover a problem, call ETC Systems Group. Refer to *Contacting ETC, page 2*.

Main Circuit Breaker Protection

Before beginning installation of your Sensor3 dimmer rack(s), make sure you have installed a main circuit breaker cabinet or other readily accessible input power disconnect device. See *Appendix D: Sensor3 Rack Specifications, page 49*, for individual rack power requirements. For bussed rack installations, this may be in the Auxiliary Bay.

WARNING: ***Dimmer racks installed without an accessible power disconnect device cannot be serviced or operated safely.***

Obtain ETC Approval to Energize the System

You need ETC approval to apply power to your dimming system. You can get pre-approval for some installations during the purchase process, or pass a wiring inspection by an authorized ETC representative after the system is installed. Wiring errors in unauthorized installations may endanger operators or cause system damage and failure.

WARNING: ***Do not attempt to energize the system without proper approval. Energizing the system without ETC approval may result in serious injuries.***

CAUTION: *Energizing your system without ETC approval may result in equipment damage that may not be covered under your warranty!*

Wiring Requirements

Line/Feed Wiring

You may feed your rack with either copper or aluminium feeder wire. See the table*: Rack Line Lug Sizes, page 13* for information on possible feed wire sizes using the standard lugs provided by ETC.

Other lugs or termination methods may be acceptable; contact ETC's applications engineering department for details. See*Contacting ETC, page 2* for contact information.

Note: *When feeding an SR48 or HSR48 with aluminium wire, you will need to derate the rack from 800A to 600A maximum current. This is due to the available space for wire termination.*

Load Wiring

The output load wiring from your rack must be 90°C rated copper wire only. In order to determine the correct conductor sizing for your rack, ***use 90°C conductors at the 75°C ampacities***, based on your local electrical code.

See *Rack Numbering and Torque Information Stickers, page 17* for the torque values for load connections.

Wire Routing

Sensor3 racks have conduit knockouts or access panels at the top and bottom. Line and load wiring can enter from the top or bottom. Control cables can enter from the top, bottom or side. Signal and power wiring must be run in separate conduit.

CAUTION: *A two-wire circuit with **separate hot and neutral conductors is required** for every branch circuit that will be connected to the dimmer rack. Shared neutral (multiwire) branch circuit arrangements are not recommended for phase-control dimming systems due to harmonics and potentially elevated neutral currents in a shared neutral arrangement.*

For retrofit installations where shared neutral circuits are already installed, or track lighting installations where the track has a shared neutral, consult ETC Technical Services for rack installation guidelines.

Where to Mount the Rack

Sensor3 dimmer racks require 10 inches (254mm) of top clearance for proper airflow through the cabinet. To allow the door to open sufficiently to install and remove modules, install the rack with 17 inches (432mm) of front clearance and 6 inches (152mm) clearance to the left of the door hinge from walls or other equipment.

Note: *Additional Sensor3 racks of the same size are the single exception to the 6 inches left clearance rule. They can be installed side by side without problems.*

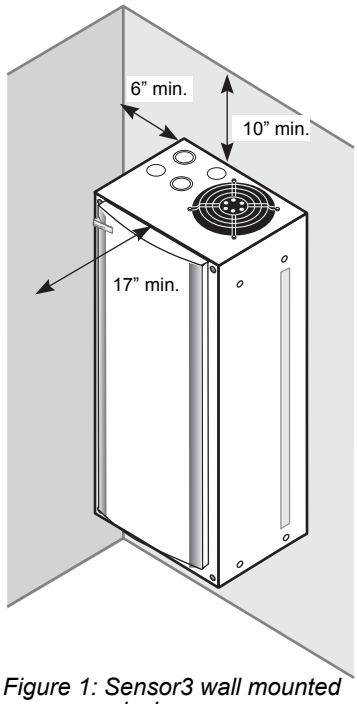


Figure 1: Sensor3 wall mounted rack clearances

Dimmer Room Requirements

- A main circuit breaker cabinet or other readily accessible input power disconnect device (can be in the Auxiliary Bay for bussed racks). Main breakers not in the same room must have a physical means to be locked off.
- A clean (not dusty) temperature-controlled environment
- Restricted public access to prevent tampering
- Soundproofing or performance area separation to muffle ventilation fan noise

Please see *Appendix D: Sensor3 Rack Specifications, page 49*, for environmental details.

6 and 12 module racks are normally wall-mounted. 24 module racks can be wall or pedestal mounted. 48 module racks are designed to be free standing.

When wall mounting racks, install racks with the Control Electronics Module (CEM3) between two and five feet from the floor. In 6, 12, and 24 module racks, the CEM3 is in the bottom slot. In the 48 module rack, the CEM3 slot is in the middle.

Chapter 2
Installation of Individual Racks

Mounting the Rack

- 6 and 12 module racks are normally wall-mounted.
- 24 module racks can be mounted to a wall or floor-mounted on an optional pedestal.
- 48 module racks are floor standing.

Mounting Racks on a Wall (6, 12, and 24 Module Racks)

The wall must be strong enough to hold the racks. Please see *Appendix D: Sensor3 Rack Specifications, page 49* for rack and module weights.

Step 1: Determine where your rack will be installed using *Figure 1: Sensor3 wall mounted rack clearances on page 5* and use the appropriate diagram from *Figure 2* to mark your mounting holes.

Note: *Sensor3 racks of the same size are the single exception to the 6 inch left clearance requirement. They can be installed side by side without problems.*

Step 2: Use the mounting slot dimensions to mark the hole locations. You must supply your own 3/8 inch mounting hardware (lag bolts recommended).

Step 3: Drill the holes and install the hardware.

Step 4: Attach the rack to the wall.

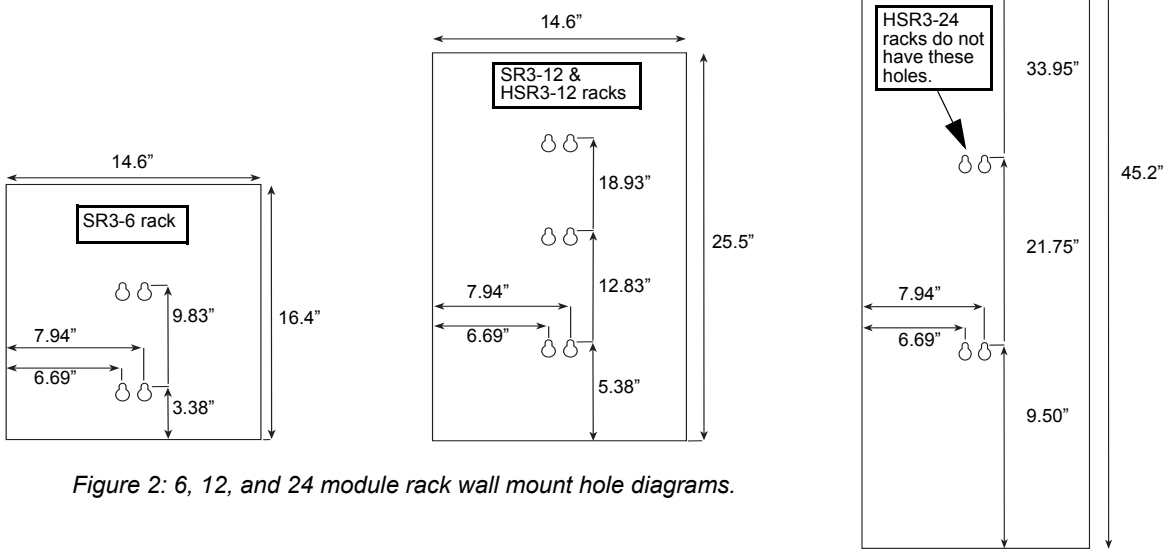


Figure 2: 6, 12, and 24 module rack wall mount hole diagrams.

Installing 48 Module Racks on the Floor

Step 1: Determine where your rack will be installed using *Figure 3* and use the appropriate diagram from *Figure 4* to mark your mounting holes.

Note: *Sensor3 racks of the same size are the single exception to the 6 inch left clearance requirement. They can be installed side by side without problems.*

Step 2: Drill the holes and install your own 3/8 inch mounting hardware. (Lag bolts recommended)

Step 3: Position the rack in the desired location.

Step 4: Adjust the leveling feet with an open end 1/2 inch wrench until the rack is level and plumb.

Note: *48 module installation racks are tall, narrow, and heavy. Use caution to keep racks stable until conduit is installed.*

Step 5: Secure the rack to the floor using your mounting hardware.

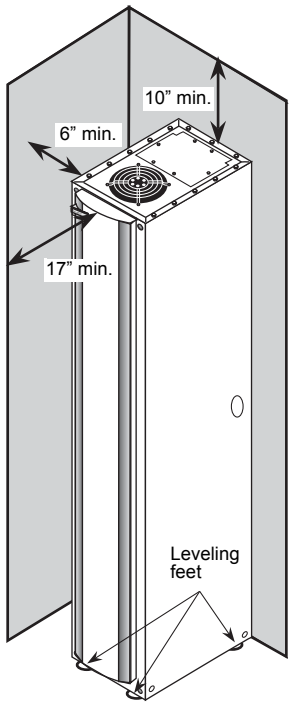
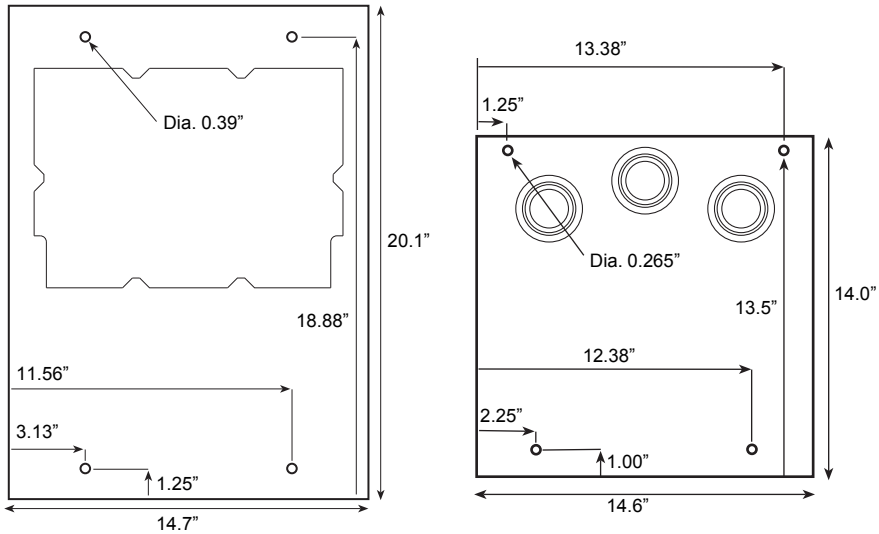


Figure 3: Floor mounted rack clearances



(H)SR3-48 floor mount hole diagram

(H)SR3-24 pedestal mount hole diagram

Figure 4: Hole diagrams for mounting racks to the floor or a pedestal

Pedestal Mounting a 24 Module Rack

Step 1: Use *Figure 4* to mark the location of the 24 module rack mounting holes. The 24 module pedestal has the same floor mounting dimensions as the 24 module rack.

Note: *You must supply 1/4 inch mounting hardware. The pedestal has four mounting holes into the floor and four securing the rack.*

Step 2: Drill holes or mount floor hardware and position the pedestal on them.

Step 3: Secure the pedestal base to the floor.

Step 4: Position the rack on the pedestal and align the mounting holes.

Step 5: Bolt the rack into place.

Securing 24 and 48 Module Racks to a Wall

Racks installed on the floor or a pedestal can also be secured to a wall for greater stability.

Step 1: Prepare the rack for floor or pedestal mounting (*Installing 48 Module Racks on the Floor, page 7* or *Pedestal Mounting a 24 Module Rack, page 7*).

WARNING: ***Make sure the holes for the mounting hardware are located where the hardware cannot come into contact with electrical wiring. Bussing and wire configurations will vary depending on installation types. Make all modifications in accordance with applicable local electrical codes.***

Note: *48 module rack enclosures do not have wall mounting holes. Drill two or more securing holes through the top third of the cabinet.*

Step 2: Mark the locations for your securing hardware on the wall.

- For 24 module racks, use the diagram in *Figure 4* to determine where you need to install your hardware
- For 48 module racks, put the rack in position and mark the holes directly.

Note: *Be sure to level 48 module racks before marking the hole positions.*

Step 3: Drill holes or install mounting hardware in the marked locations.

Step 4: Finish mounting the rack to the floor or pedestal.

Step 5: Attach the rack to the wall with your securing hardware.

Wall Mounting Racks Using Vibration Pads

Vibration damping fittings are available as an option for wall mounted racks (6, 12, and 24 module racks). The wall must be strong enough to hold the racks. Please see *Appendix D: Sensor3 Rack Specifications, page 49* for rack and module weights.

Note: *Be sure this mounting method complies with local building and electrical codes.*

Step 1: Mark the hole locations on the wall from *Figure 4: Hole diagrams for mounting racks to the floor or a pedestal on page 7*.

Note: *ETC's wall mount vibration pads (ETC Part# HW6111) attach to racks with 1/2 inch bolts that are slightly larger than the top of the keyhole slots. The bolt works fine installed in the lower portion of the slot, but the rack will mount slightly higher (approximately 1/2 inch) than the diagram indicates.*

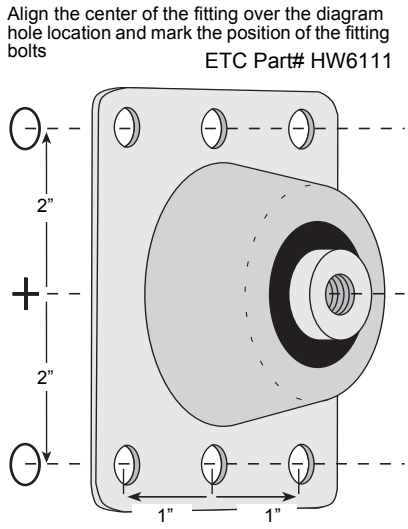

Align the center of the fitting over the diagram hole location and mark the position of the fitting bolts
ETC Part# HW6111
2”
2”
1”
1”

Figure 5: Positioning a vibration pad on a wall

Step 2: Align the center of the fitting over the hole locations from the diagram. Mark the position for two fitting bolts for each vibration pad (the middle holes are recommended).

Step 3: Drill the holes and secure the fittings to the wall. You must supply your own 7/16 inch mounting hardware (lag bolts recommended).

Step 4: Remove the included 1/2 inch bolt and washer from each vibration fitting.

Step 5: Position the rack on the wall so the centers of the vibration fittings align with the wall mounting slots.

Step 6: Secure the rack to its vibration pad with the 1/2 inch bolts and washer.

CAUTION: *Unless mounting is done and connections are made in a flexible manner, the effectiveness of the vibration pads will be reduced or completely negated. Proper connections include the use of a minimum of 1' of flexible conduit for all electrical connections to the rack(s).*

Floor Mounting Racks Using Vibration Pads

48 module racks can be floor mounted on optional vibration damping fittings (ETC Part# HW6109).

Step 1: Determine where your rack will be installed using *Figure 3: Floor mounted rack clearances on page 7*.

Note: *Be sure this mounting method complies with local building and electrical codes.*

Level 48 module racks before marking the hole positions.

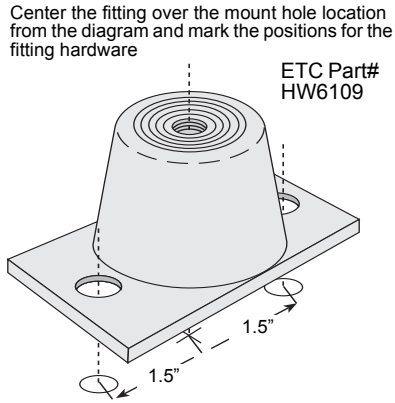

Center the fitting over the mount hole location from the diagram and mark the positions for the fitting hardware
ETC Part# HW6109
1.5"
1.5"

Figure 6: Floor vibration pad

Step 2: Use the appropriate diagram from *Figure 4: Hole diagrams for mounting racks to the floor or a pedestal on page 7* to mark your hole locations.

Step 3: Align the center of the vibration fitting over the hole locations from the diagram. Mark the positions for two bolts for each vibration pad.

Step 4: Drill the holes and secure the pads to the floor. You must supply your own 11/32 inch mounting hardware (lag bolts recommended).

Step 5: Remove the included 3/8 inch bolt and washer from each vibration pad.

Step 6: Position the rack on the pads so the center holes of the pads align with the mounting holes in the base of the rack.

Step 7: **[Optional]** If required, secure the rack to a wall using wall mount vibration pads (ETC Part# HW6111). If the vibration pads are requested for the installation, they are included with the rack.

- Follow instructions from *Securing 24 and 48 Module Racks to a Wall, page 8* to drill holes in the back of the rack for wall mounting.
- Mount the rack to the wall using the procedure from *Wall Mounting Racks Using Vibration Pads, page 8*, above.

Step 8: Secure the rack to the pads with the 3/8 inch bolts.

CAUTION: *Unless mounting is done and connections are made in a flexible manner, the effectiveness of the vibration pads will be reduced or completely negated. Proper connections include the use of a minimum of 1' of flexible conduit for all electrical connections to the rack(s).*

Securing Multiple Racks (Optional)

Multiple racks can be connected to each other for greater stability. This is not the same as bussed racks. Bussed racks include hard bussing copper to physically connect the line power through multiple racks. For proper bussed rack installation, please see *Installation of Bussed Racks, page 15*.

Note: *If you want to install the control cable through the side of the racks, remove the side cable knockouts before connecting the racks.*

Step 1: Use 1/2 inch long bolts and lock nuts in the front and at the back to bolt the racks together at the bottom.

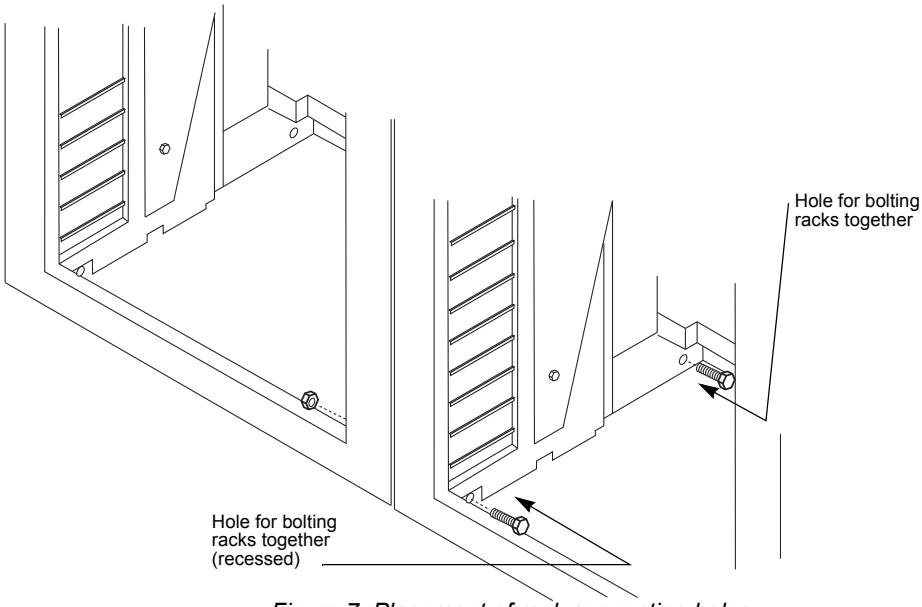


Figure 7: Placement of rack connecting holes

Note: *The front bolt is difficult to reach – you may need a magnetic bolt-driver or socket extension.*

Step 2: Remove six screws from the tops of adjacent racks, as shown below.

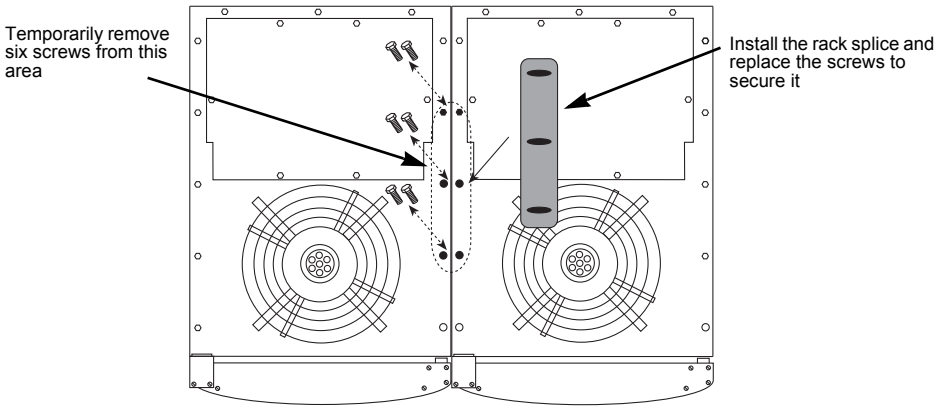


Figure 8: Screws to remove to connect two racks

Step 3: (48 module only) Place a rack splice plate over the empty screw holes and replace the screws you removed in Step 2 as shown above.

Step 4: Repeat Steps 1, 2 and 3 until you've secured all of the racks.

Connect Line Power Wiring

ETC recommends routing line (feeder) wires first, load neutral and load ground wires next, and load phase wires last.

CAUTION: *Copper and aluminum are both acceptable for line and load wiring but have restrictions. Reference the Dimmer Rack and Aux Bay Ratings, page 29 before installation to ensure your system does not void UL.*

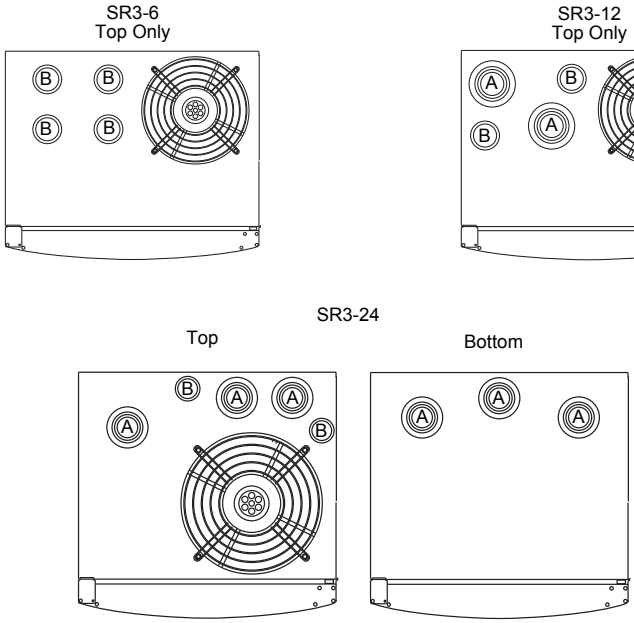
CAUTION: *Dress wires neatly and avoid leaving extra wire inside the rack. Too much clutter (especially along the right side of the rack) can restrict air circulation and reduce cooling efficiency. If cabling interferes with airflow during operation, the rack may shut down due to overheating.*

Attaching Line Power Wire and Conduit

Line cable and power wire conduits should enter the rack through the designated top and bottom access points.

6, 12, and 24 Module Rack Wire and Conduit Access

These racks have removable conduit knockouts.



Knockout sizes		
Type	Conduit (in inches)	Hole size (in inches)
A	1, 1¼, 1½, 2	$1\frac{3}{8}$, 1¾, 2, 2½
B	1, 1¼	$1\frac{3}{8}$, 1¾

Figure 9: Conduit knockouts

Step 1: Remove the desired top or bottom wire knockouts.

Step 2: Install the appropriate conduit in the holes.

48 Module Wire and Conduit Access

48 module racks have removable top and bottom access panels.

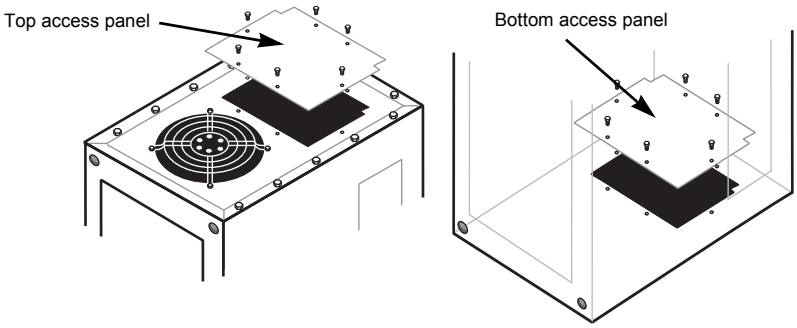


Figure 10: 48 module access panels

Step 1: Remove the desired access panel from the rack.

Step 2: Cut access holes in the top and bottom access panels.

Step 3: Install your conduit fittings into the holes.

Step 4: Re-install the access panel so that there are minimal air gaps. *See "Sealing Rack Air Leaks" on page 40.* for more information.

Using a Wire Trough for Line Power Wire Access

Step 1: Remove the desired wire knockouts (6, 12, or 24 module racks) or access panel (48 module rack).

Step 2: (6, 12, and 24 module racks) Install conduit fittings or grommets in the openings.

Step 3: (48 module) Cut the necessary opening in the access panel and reinstall it.

Note: *Wire openings must have fittings or linings to protect wire and cable insulation from damage by sharp metal edges.*

Step 4: Position the wire trough above the prepared opening.

Connect Line Feed Cable

Line feed cables are terminated on the rack's line phase, neutral and ground lugs. Phase and neutral lugs are located on bus bars.

Table 1: Rack Line Lug Sizes

Rack Type	Hot and Neutral Lugs	Ground Lugs
SR3-6	2 x 2/0	2 to 14 AWG (25 to 2.5mm^2)
SR3-12 and HSR3-12	2 x 250 kcmil to 6 AWG (120 to 16mm^2)	
SR3-24 and HSR3-24	2 x 350 kcmil to 6 AWG (150 to 16mm^2)	
SR3-48 and HSR3-48	2 x 600 kcmil to 2 AWG (300 to 35mm^2)	250 kcmil to 6 AWG (120 to 16mm^2)

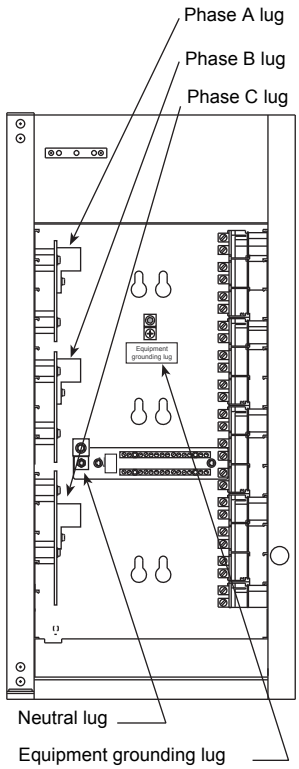


Figure 11: Line cable lug locations

Note: *The lugs are not suitable for fine-stranded wire.*

Note: *The Neutral Disconnect bussing used by Ground Fault Interrupt racks have different line connection orientations.* *See "Connecting Ground Fault Circuit Interrupt Racks (120V GFCI)" on page 38.* *for line connection points.*

Step 1: Pull the line phase, neutral and ground cables to the rack through the openings you prepared previously. *See "Attaching Line Power Wire and Conduit" on page 11.*

Note: *Phase, neutral and ground lug orientation is reversible to make top or bottom line cable easier. Lugs are shipped in top entry orientation.* ***Be sure to leave access to the lug's bolt for tightening later.***

Step 2: Strip one inch of insulation from the end of the line phase, neutral and ground cables and attach them to the correct lugs. *Line connections are labeled* ***A****,* ***B****,* ***C****,* ***N****, and* ***Equipment Grounding Lug****.*

Note: *The example in Figure 11 shows a three phase rack. On 120 V single phase racks are shipped with two phase bus bars labeled* ***L1****and* ***L2****.*

WARNING: ***Do not try to modify any Sensor3 rack to use a single line feed by jumpering between phase bars. Single feed operations will result in overcurrents on the neutral bus, and may cause fire or equipment failure.***

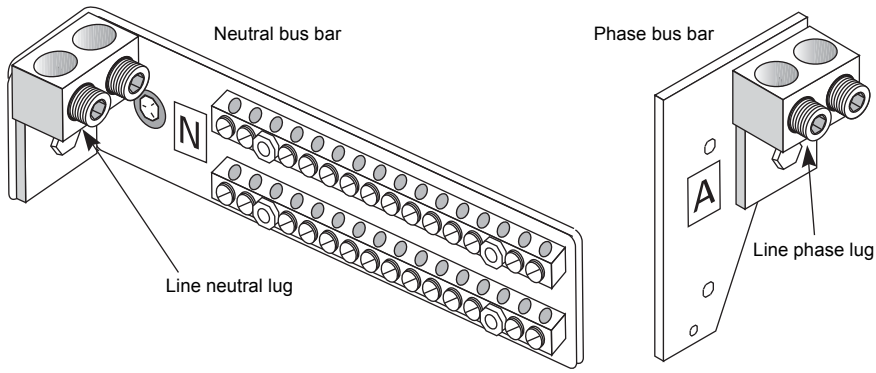


Figure 12: Line cable bus connections

Step 3: Tighten the lugs to the correct torque based on cable size.

Table 2: Line lug torque

Cable size	Torque Pound Inches	Torque Pound feet	Torque N-m
4 to 6 AWG (25 to 16mm^2)	110 lb-in.	9.2 lb-ft.	12.4 N-m
1 to 2 AWG (35mm^2)	150 lb-in.	12.5 lb-ft.	16.9 N-m
1/0 to 2/0 AWG (50 to 70mm^2)	180 lb-in.	15 lb-ft.	20.3 N-m
3/0 to 4/0 AWG (95mm^2)	250 lb-in.	20.8 lb-ft.	28.2 N-m
250 to 450 kcmil (120 to 185mm^2)	325 lb-in.	27.1 lb-ft.	36.7 N-m
500 to 750 kcmil (240 to 300mm^2)	375 lb-in.	31.3 lb-ft.	56.5 N-m

If you are not installing bussed racks, please skip ahead to *Section 4: Land Load Wires, page 36*.

Chapter 3
Installation of Bussed Racks

Configurations of Bussed Racks

12 Module Racks

Bussed 12 module racks are available connected to an Auxiliary Bay only. It is recommended that no more than two racks and an Auxiliary Bay be bussed together. The Auxiliary Bay can contain a Main Circuit Breaker (MCB) for the racks.

Racks can be shipped with all bussing connections complete, or as two racks and one Auxiliary Bay. Racks that are shipped assembled can be mounted immediately on a wall or pedestal without further assembly. *See "Mounting Bussed Racks on a Wall (12 and 24 Module)" on page 26.* for instructions.

24 Module Racks

Bussed 24 module racks are available connected to an Auxiliary Bay or bussed together. There is no physical limit to how many racks can be bussed together, but usually four is the maximum due to power feed limitations. If an Auxiliary Bay is included in the bussed assembly, it can contain a Main Circuit Breaker (MCB) for the racks.

Up to three 24 module racks can be shipped with all bussing connections complete, or two racks and one Auxiliary Bay. Racks that are shipped assembled can be mounted immediately on a wall or pedestal without further assembly. *See "Mounting Bussed Racks on a Wall (12 and 24 Module)" on page 26.* for instructions.

Racks shipped separated must be bolted together and bussing connections between the racks must be completed before the racks can be secured in their installation location. See *Secure Racks Together, page 18* for instructions.

48 Module Racks

Bussed 48 module racks are available connected to a 19 or 30 inch Auxiliary Bay or bussed together. There is no physical limit to how many racks can be bussed together, but usually four is the maximum due to power feed limitations. If an Auxiliary Bay is included in the bussed assembly, it can contain a Main Circuit Breaker (MCB) for the racks. Both19-inch and 30-inch bays can house one MCB. The 19-inch bays are limited to 800A maximum and 30-inch bays are limited to 1600A with MCB or 2000A with main lugs.

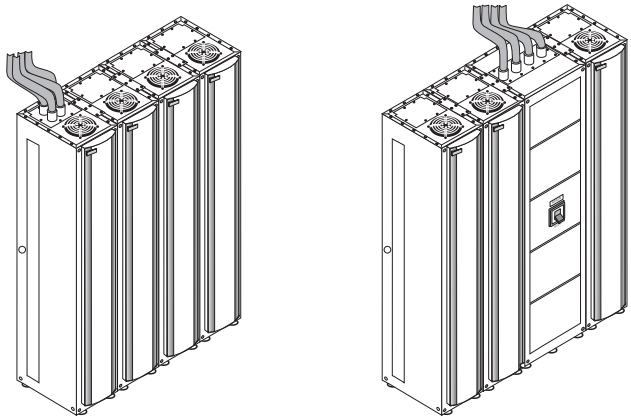


Figure 13: SR3-48 and HSR3-48 bussing options

Two 48 module racks or one rack and one Aux Bay can be shipped with all bussing connections complete. Racks that are shipped assembled can be mounted without further assembly. See *Installing 48 Module Racks on the Floor, page 27* for instructions.

Racks shipped separately must be bolted together and bussing connections between the racks must be completed before the racks can be secured in their installation location. See *Secure Racks Together, page 18* for instructions.

Putting Racks in Installation Order

It is important that bussed racks are connected in proper order. Bussing order is called out in job drawings and is also indicated by rack number. You can also often determine a rack's position based on the configuration of side access panels and bussing preparation.

Access Panel Configurations by Rack Position

Dimmer racks are shipped with bussing access panels prepared for installation. You can use the panel configuration to help identify racks' positions in bussed assemblies.

- Racks on the left side of an assembly have the left side access panel in place and right side panel replaced by a fiche paper (Nomex) air baffle
- Racks in the middle have the right panel replaced by an air baffle and the left panel removed.
- Racks on the right side of the assembly have the right access panel in place and the left removed.

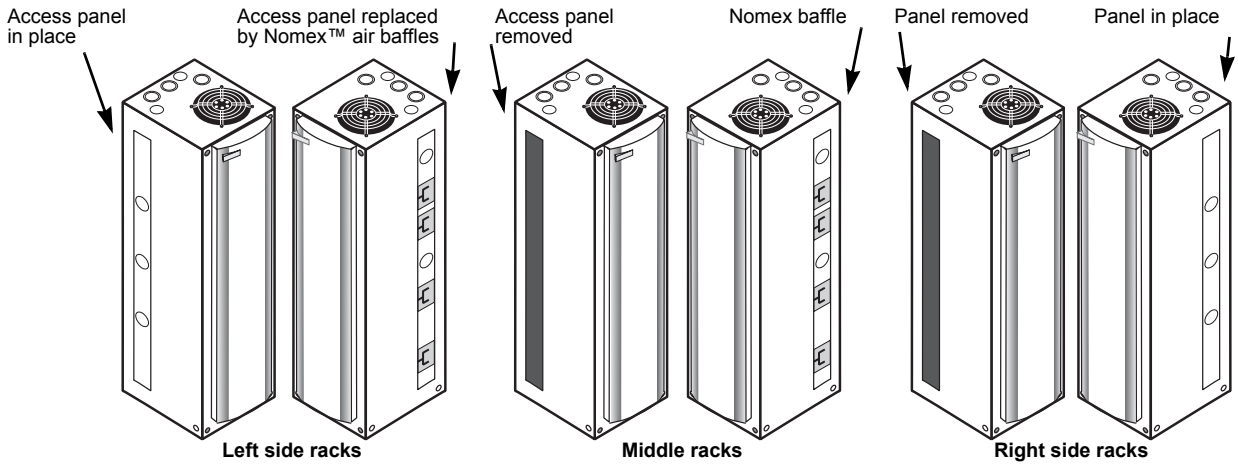


Figure 14: Rack access panel configuration

Note: *Some installations will have separate groups of bussed racks, resulting in multiple "left" and "right" side racks. Always check your job drawings and rack ID labels to confirm a rack's installation position.*

Rack Numbering and Torque Information Stickers

Each dimmer rack has a rack identification label. Use the label to identify the rack in the configuration. Rack numbering begins on the left and goes on to the right. Auxiliary Bays are not numbered

Note: *Some customers specify non-standard rack numbering based on special installation requirements.Custom numbering arrangements should be called out in the job drawings or specified to installers.*

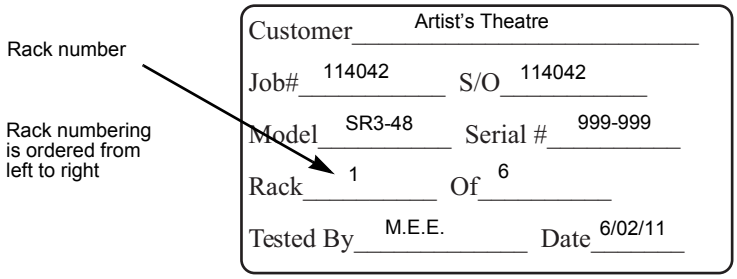

Rack number
Rack numbering is ordered from left to right
Customer Artist's Theatre
Job# 114042 S/O 114042
Model SR3-48 Serial # 999-999
Rack 1 Of 6
Tested By M.E.E. Date 6/02/11

Figure 15: Rack identification labels

The identification label is located on the phase A bus in each SR3-48 rack. It is on the base of each SR3-12 and SR3-24 rack.

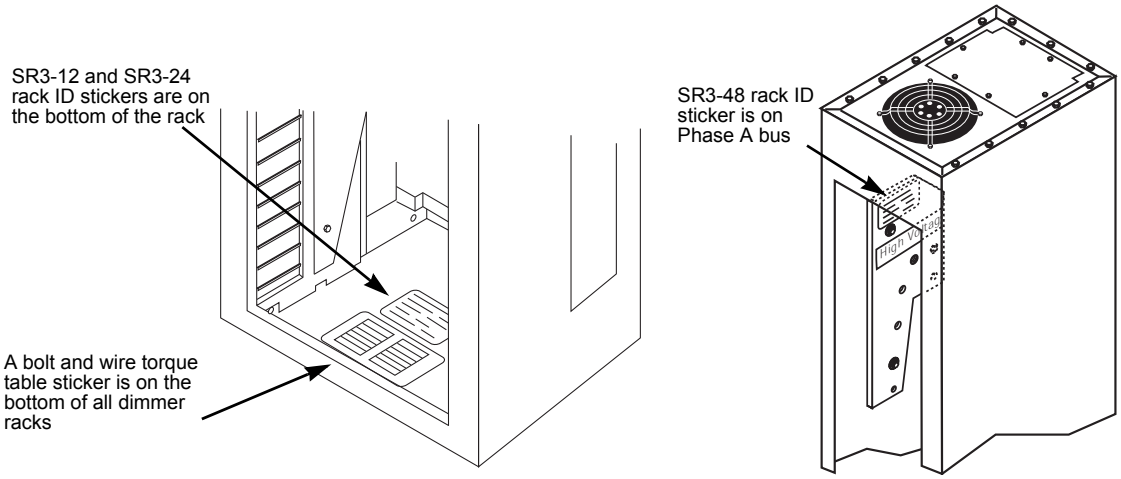

SR3-12 and SR3-24 rack ID stickers are on the bottom of the rack
A bolt and wire torque table sticker is on the bottom of all dimmer racks
SR3-48 rack ID sticker is on Phase A bus

Figure 16: Locating the rack ID sticker

Each rack has a sticker on the bottom with a table of torque values.

Table 3: Bolt and wire torque values

Bolt Tightening Torque Values

Internal socket size across flats	Maximum tightening torque
1/8 inch	45 lb-in. (5 N-m)
5/32 inch	100 lb-in. (11 N-m)
3/16 inch	120 lb-in. (13.5 N-m)
7/32 inch	150 lb-in. (17 N-m)
1/4 inch	200 lb-in. (22.5 N-m)
5/16 inch	275 lb-in. (31 N-m)
3/8 inch	375 lb-in. (42 N-m)
1/2 inch	500 lb-in. (56.5 N-m)
9/16 inch	600 lb-in. (68 N-m)

Wire Tightening Torque Values

AWG or kcmil size	Screwdriver	External drive wrench
14, 12, 10, 8	35 lb-in. (4 N-m)	75 lb-in. (8.5 N-m)
6, 4	45 lb-in. (5 N-m)	110 lb-in. (12.5 N-m)
2, 1	50 lb-in. (5.5 N-m)	150 lb-in. (17 N-m)
1/0, 2	50 lb-in. (5.5 N-m)	180 lb-in. (20 N-m)
2/0, 4/0	N/A	250 lb-in. (28 N-m)
250, 350 kcmil	N/A	325 lb-in. (36.5 N-m)
500, 600 kcmil	N/A	375 lb-in. (42 N-m)

Secure Racks Together

After the racks are in their installation order, they must be secured together before connecting bussing to maintain correct tolerances and avoid stress to power components during installation.

Step 1: Use 1/4 inch bolts and lock nuts in the front and at the back to bolt the racks together at the bottom.

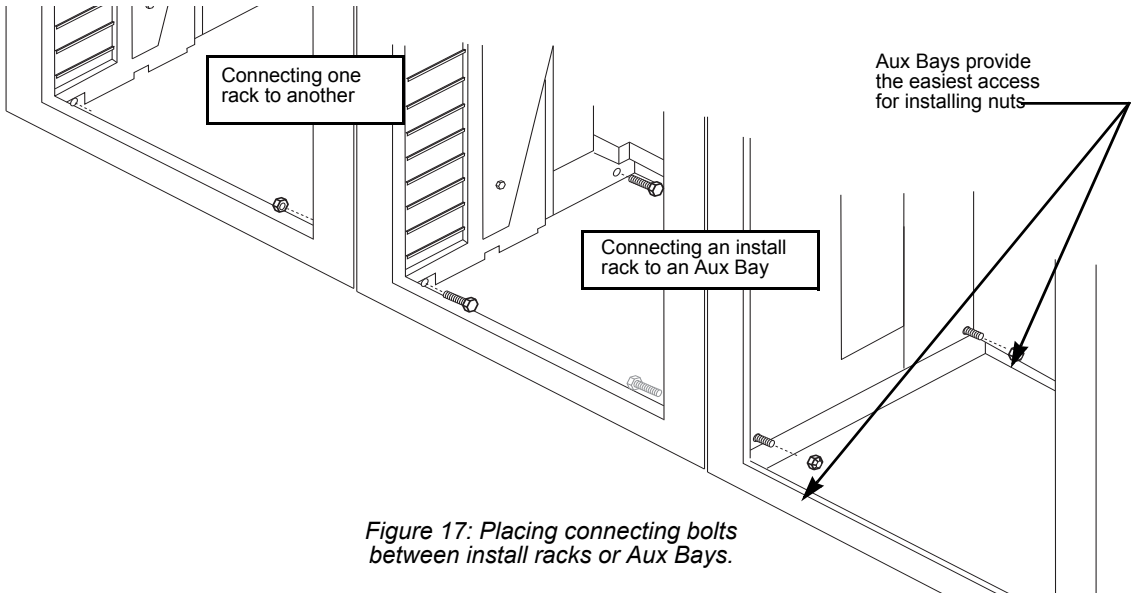

Connecting one rack to another
Aux Bays provide the easiest access for installing nuts
Connecting an install rack to an Aux Bay

Figure 17: Placing connecting bolts between install racks or Aux Bays.

Note: *The front bolt is difficult to reach – you may need a magnetic bolt-driver or socket extension.*

Step 1: Remove 6 screws from the tops of adjacent racks or Auxiliary Bays.

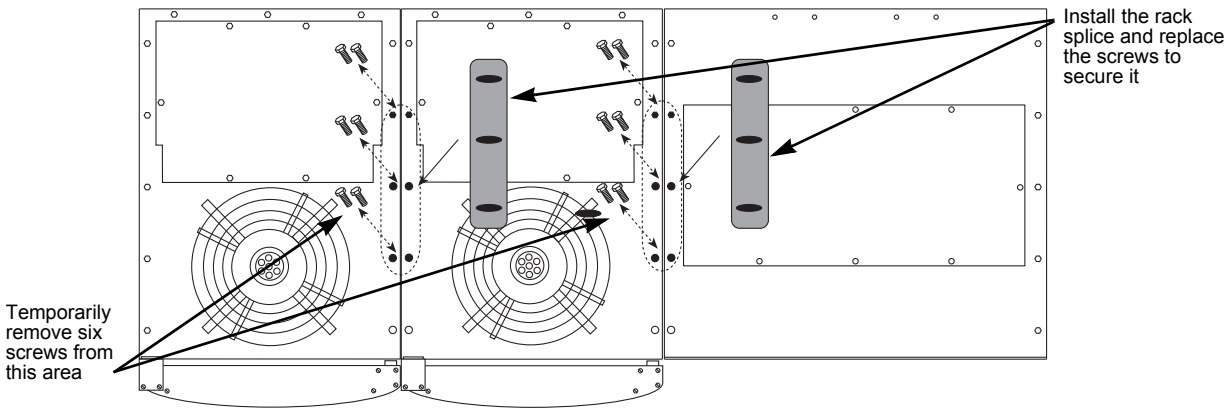


Figure 18: Screws to remove to connect two racks

Step 2: Place a rack splice plate over the empty screw holes and replace the screws you removed in Step 1 as shown above.

Step 3: Repeat Steps 1, 2 and 3 until you've secured all of the racks.

Making the Bus Connections Between Racks

Bussed racks are shipped with as much of the bussing connections completed as possible. Connections between separately-shipped racks cannot be finished until the racks are secured together. See *Secure Racks Together, page 18* for instructions.

CAUTION: *Bus bars connected between unsecured racks are subject to physical stresses that may damage or destroy bus bar components. Finish securing racks together before making bussing connections.*

Begin installing your bussing components in the rack where the line power connections will be made. These bus connections will carry the most current and may use multiple bus bars to handle current load.

Installing the Neutral Bus Plates

The neutral bus plate is loosely installed in the rack at time of shipping. It may need to be removed for bus bar installation.

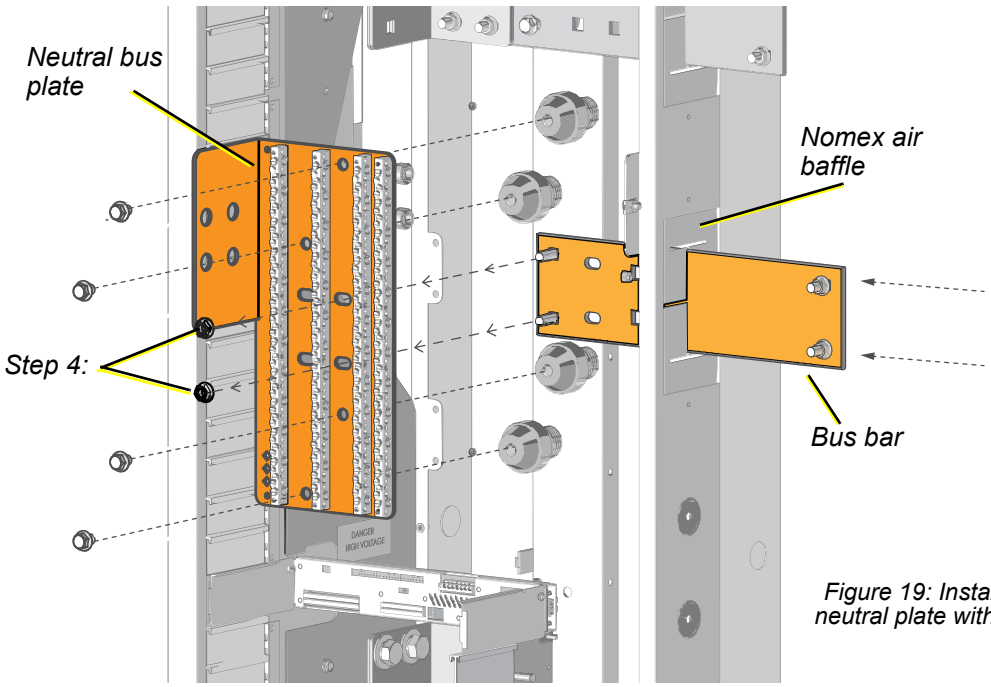


Figure 19: Installing the neutral plate with bus bar

Step 1: Remove the neutral plate and bolts and set aside. They will be reinstalled later in the process.

Step 2: Consult your job drawings to determine how many bus bars are needed between your neutral plates.

Step 3: Slide bus bar(s) in through the Nomex air baffle on the side of the rack.

Step 4: Connect the neutral bus plate to the neutral bus bar(s) with the included carriage bolts.

Note: *If the line power is connected at the center rack, only connect the bus bar(s) to one side of the neutral plate. Connect the bus bar(s) on the other side after completing Step 6.*

Step 5: Reattach the neutral plate assembly to the Glastic™ standoffs on the back of the rack with the included hardware. Do not overtighten.

Step 6: Repeat steps 4 and 5 with any additional racks until all are installed and bussed together.

Step 7: Tighten all neutral bus hardware, except the bolts securing the neutral bus assembly to Glastic standoffs, to the values on the Torque Values sticker on the bottom of the rack or in *Table 3 on page 17*.

- 9/16 inch bolts – 20 lb-ft (27 N-m). maximum
- 7/16 inch bolts – 15 lb-ft (20 N-m). maximum

Note: *Bolts securing the neutral bus assembly to the Glastic standoffs on the back of the rack must not be overtightened or the standoffs will break.*

Bussing Between Phase Bus Plates

Step 1: Place the bus bar through the side openings provided on the rack and position behind the copper angle plates.

Step 2: Lightly secure it to the Glastic standoffs with the included bolt/washer combination.

Step 3: Insert the two securing carriage bolts through the square holes in the bus bar and slide the spacer plate over the bolt ends.

Step 4: Secure the bar to the plate assembly with the included nut/washer sets.

Step 5: Torque the fasteners, except the bolts securing bus assemblies to Glastic standoffs, using the values in on the Torque values sticker on the bottom of the rack, or see *Table 3 on page 17*.

- 9/16 inch bolts – 20 lb-ft (27 N-m). maximum
- 7/16 inch bolts – 15 lb-ft (20 N-m). maximum

CAUTION: *Bolts securing the bus assemblies to Glastic standoffs on the back of the rack must not be overtightened or the standoffs will break.*

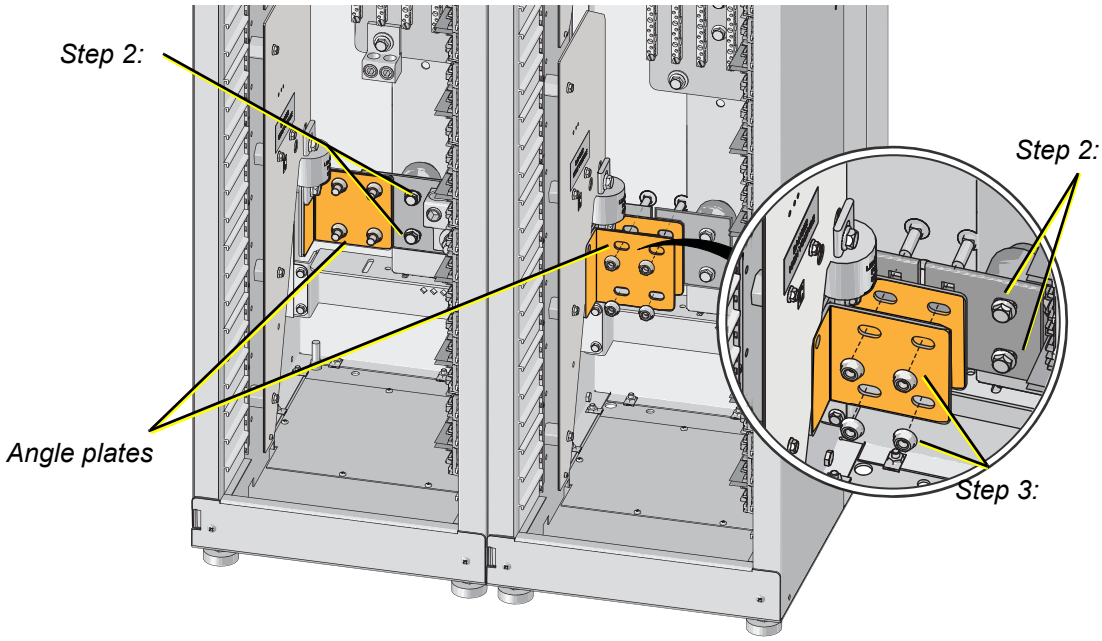


Figure 20: Attaching bus bars in a rack with fuses

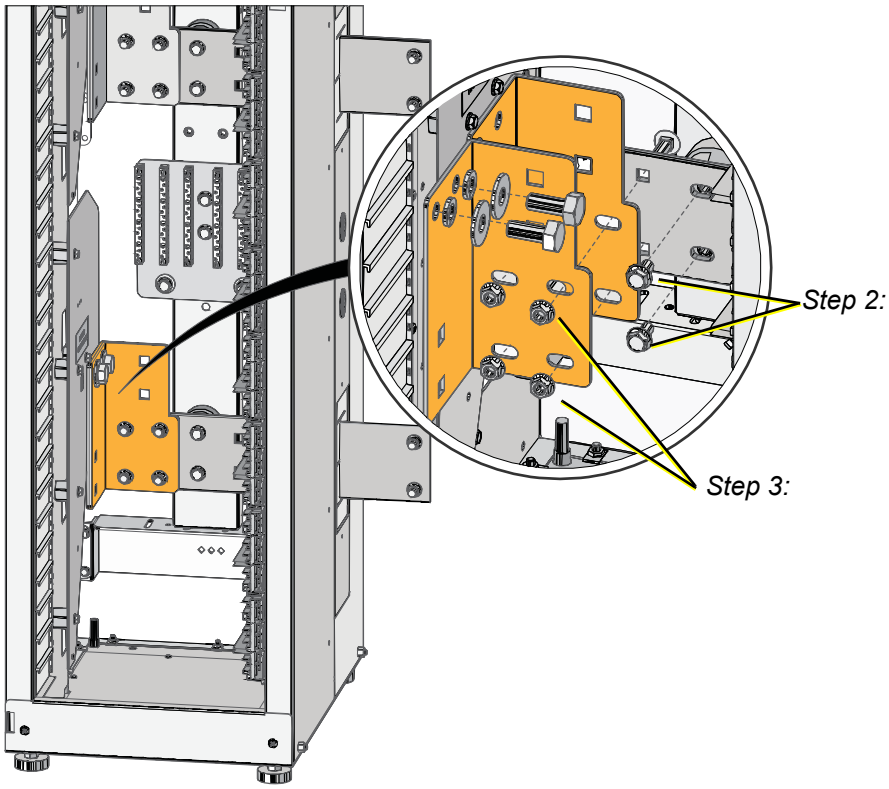


Figure 21: Connecting bus bars in a rack without fuses.

The bus bar configuration for racks at the end of a line have a slightly different appearance when installed correctly. See below for reference.

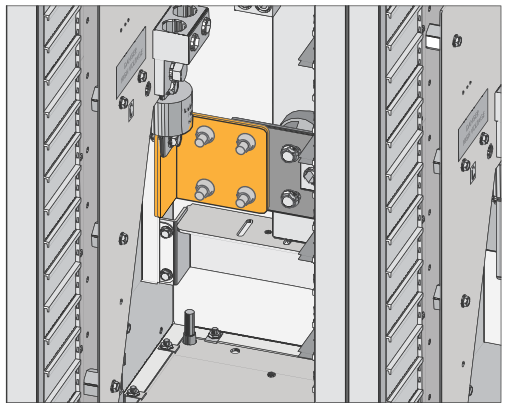


Figure 22: Left end rack

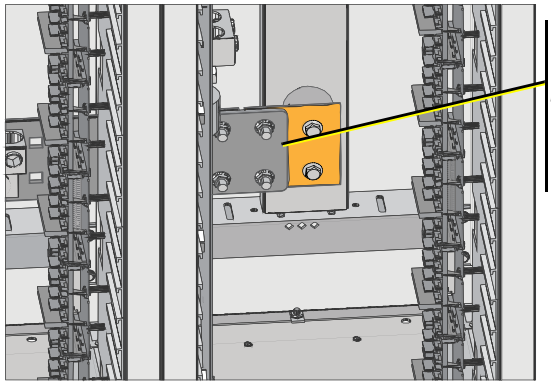


Figure 22: Right end rack

Soft Bussing Between Ground Bus Plates

Ground bus plates are shipped installed in the rack. Soft bus cables are included with the rack for bussing ground plates together.

To in stall the soft bus cables:

Step 1: Unscrew the lower two bolts holding the ground plate into the rack.

Step 2: Insert the bolt through the lug on the pre-assembled cable supplied.

Step 3: Run the cable to the adjacent rack and connect the lug to the ground plate in the same manner.

Step 4: Repeat for any additional racks requiring ground bussing.

Step 5: Torque the cable lugs using the values in on the Torque values sticker on the bottom of the rack, or see *Table 3 on page 17*.

Making Bus Connections to an Auxiliary Bay

Auxiliary Bays are available in 19 and 30 inch widths. Except for the length of the bus bars, the installation procedure for both sizes are the same.

Bussing connections cannot be finished until all racks are secured together. See *Secure Racks Together, page 18* for instructions.

CAUTION: *Bus bars connected between unsecured racks are subject to physical stresses that may damage or destroy bus bar components. Finish securing racks together before making bussing connections.*

Begin installing your bussing components in the Auxiliary Bay where the line power connections will be made. These bus connections will carry the most current and may use multiple bus bars to handle current load. Before installation, confirm your dimmer rack and Aux Bay load rating with *Dimmer Rack and Aux Bay Ratings, page 29*.

Installing the Aux Bay Bus Bars

Bus bars bolt directly to the Glastic standoffs on the back of the Aux Bay. The rack connection order should be called out on your job drawings and the necessary bus bar types for connecting through the left, right or both sides of the Aux Bay will be included.

Note: *Your Aux bay may or may not have an internal Main Circuit Breaker (MCB). The presence of an MCB does not affect bus bar installation.*

Step 1: Remove the Aux Bay front access panels with a #2 Phillips screwdriver.

Step 2: Use the job drawings for your installation to determine how many bars will be needed per phase.

Note: *Make sure all your installation complies with applicable local electrical codes.*

Step 3: Install the bus bars on the standoff using the included 3/8 inch bolts with washers and lock washers.

Step 4: Install the provided lugs on the phase bus bars.

Step 5: Torque all Aux Bay fasteners, except those securing bus assemblies to Glastic standoffs, using the values in on the Torque values sticker on the bottom of the installation racks, or see *Table 3 on page 17*.

- 9/16 inch bolts – 20 lb-ft (27 N-m). maximum
- 7/16 inch bolts – 15 lb-ft (20 N-m). maximum

Note: *Bolts securing the bus assemblies to Glastic standoffs on the back of the rack must not be overtightened or the standoffs will break.*

Connecting an Internal Main Circuit Breaker (MCB)

The optional internal MCB(s) are shipped completely installed and ready to connect to Aux Bay bus bars.

- An MCB less than 800A will use cables to connect to the bus bars. These cables are provided with the bus kit.
- Main Circuit Breakers over 800A use only the pre-bent multilayer copper plates.

Step 1: Install the bus bars according to the instructions in *Installing the Aux Bay Bus Bars, page 24*.

Step 2: If you have an MCB less than 800A, connect the provided cables from the MCB to their respective bus bars and torque them using the values in the following table.

Table 5: Line lug torque

Cable size	Torque (lb-in.)	Torque (lb-ft.)	Torque (N-m)
4 – 6 AWG	110 lb-in.	9.2 lb-ft.	12 N-m
1 – 2 AWG	150 lb-in.	12.5 lb-ft.	17 N-m
1/0 – 2/0 AWG	180 lb-in.	15 lb-ft.	20 N-m
3/0 – 4/0 AWG	250 lb-in.	20.8 lb-ft.	28 N-m
250 – 450 kcmil	325 lb-in.	27.1 lb-ft.	36.5 N-m
500 – 750 kcmil	375 lb-in.	31.3 lb-ft.	42.5 N-m
800 – 1000 kcmil	500 lb-in.	41.7 lb-ft.	56.5 N-m

Mounting the Rack

- 12 module racks are normally wall-mounted.
- 24 module racks can be mounted to a wall or on an optional pedestal.
- 48 module racks are floor standing. For stability, these racks must also be secured to the floor or wall after installation.

Note: *Store unsecured racks where they cannot fall over and use caution to keep racks stable during installation.*

Mounting Bussed Racks on a Wall (12 and 24 Module)

The wall must be strong enough to hold the racks. See *Sensor3 Rack Specifications, page 49* for rack and module weights.

Step 1: Use the mounting slot dimensions to mark the hole locations. You must supply your own 3/8 inch mounting hardware (lag bolts recommended).

Note: *If you are installing racks without attached Aux Bays, use the rack measurements on the left.*

Step 2: Drill the holes and install the hardware.

Step 3: Attach the rack(s) to the wall.

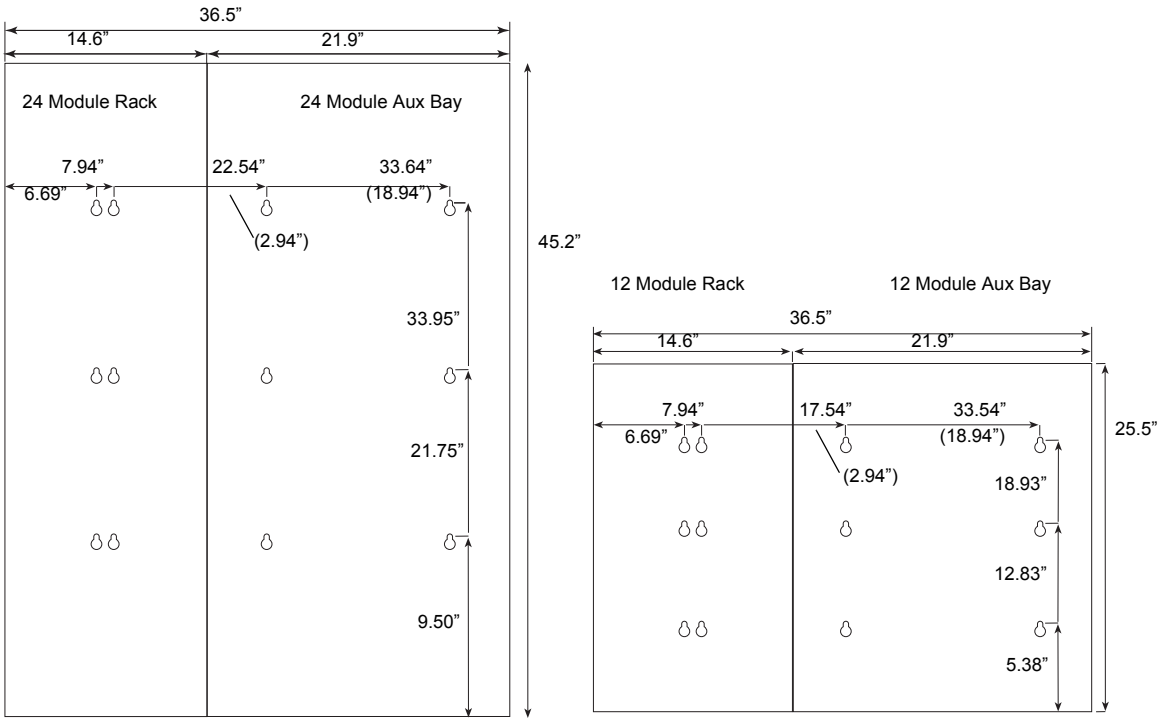


Figure 23: 24 module and 12 module rack and Aux Bay wall mount hole diagrams

Pedestal Mounting 24 Module Racks

24 module racks bussed to each other can be mounted on pedestals, however, there is no pedestal for the 24 module Aux Bay. 24 module racks bussed to Aux Bays must be wall mounted.

Step 1: Use *24 module pedestal mount dimensions, page 27*, to mark the location of the 24 module and mounting holes. The 24 module pedestal has the same floor mounting dimensions as the 24 module rack.

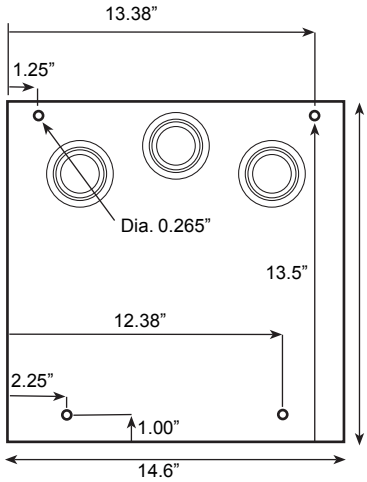


Figure 24: 24 module pedestal mount dimensions

Note: *You must supply 1/4 inch mounting hardware. The pedestal has four mounting holes into the floor and four securing the rack.*

Step 2: Drill holes or mount floor hardware and position the pedestal on them.

Step 3: Secure the pedestal base to the floor.

Step 4: Position the rack on the pedestal so the mounting holes align.

Step 5: Bolt the rack into place.

Securing Pedestal Mounted 24 Module Racks to a Wall

24 module racks installed on pedestals can also be secured to a wall for greater stability.

Step 1: Prepare the racks for pedestal mounting (see above).

Step 2: Mark the locations for your securing hardware on the wall. Use the 24 module diagram in *Figure 23* to determine where you need to install your hardware

Step 3: Drill holes or install mounting hardware in the marked locations.

Step 4: Finish mounting the rack to the floor or pedestal.

Step 5: Attach the rack to the wall with your securing hardware.

Installing 48 Module Racks on the Floor

Step 1: Determine where your racks will be installed using *Figure 25* and use the appropriate diagram from *Figure 26* to mark your mounting holes.

Step 2: Drill the holes and install your own 3/8 inch mounting hardware.

Step 3: Position the rack in the desired location.

Step 4: Adjust the leveling feet with an open end 1/2 inch wrench until the rack is level.

Note: *48 module installation racks are tall, narrow, and heavy. Use caution to keep racks stable until conduit is installed.*

Step 5: Secure the rack to the floor using your mounting hardware.

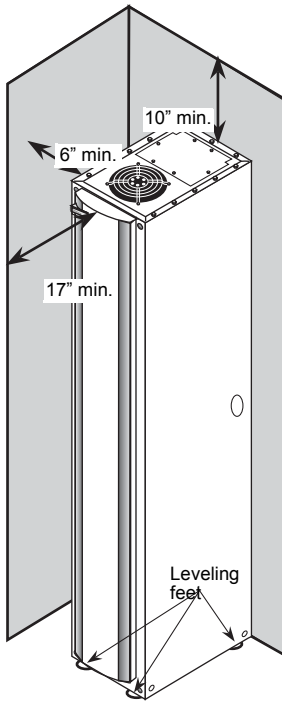


Figure 25: Floor mounted rack clearances

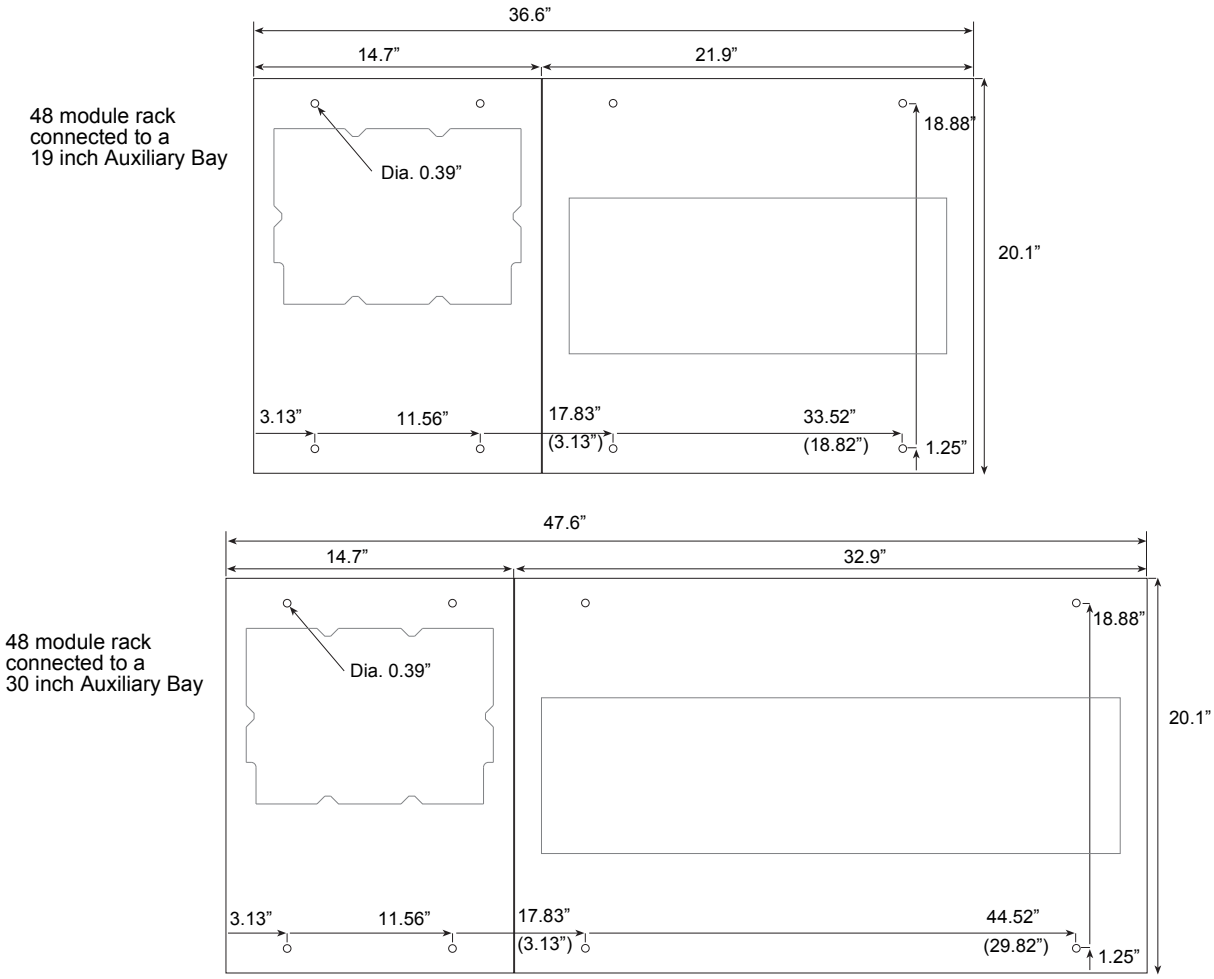


Figure 26: Hole diagrams for mounting 48 module racks to the floor

Securing 48 Module Racks to a Wall

Racks installed on the floor can also be secured to a wall for greater stability.

Step 1: Prepare the rack for floor mounting (see the previous page).

Note: *48 module rack enclosures do not have wall mounting holes. Drill two or more securing holes through the top third of the cabinet.*

CAUTION: *Mounting hardware should not come in contact with electrical wiring. Drill holes appropriately. Bussing and wire configurations will vary depending on installation types. Make all modifications in accordance with applicable local electrical codes.*

Step 2: Position the rack against the wall and mark the holes directly.

Note: *Level the 48 module racks before marking the hole positions.*

Step 3: Drill holes or install mounting hardware in the marked locations.

Step 4: Finish mounting the rack to the floor.

Step 5: Attach the rack to the wall with your securing hardware.

Connecting Main Power Through an Auxiliary Bay

Line cable access to the Auxiliary Bay is through the removable top and bottom access panels.

Note: *Copper and aluminum are both acceptable for line and load wiring but have restrictions. Reference the Dimmer Rack and Aux Bay Ratings Chart below before installation to ensure your system does not void UL.*

Dimmer Rack and Aux Bay Ratings

Standard ETC Sensor Rack Options with Maximum Current Ratings

Dimmer Racks	Suggested Max # of bussed racks	Max Current Rating of 3Ø Rack	Max Current Rating of 1Ø Rack	Max Current Rating of 3Ø 19" Aux		Max Current Rating of 3Ø 30" Aux	
				Aluminum[1]	Copper[2]	Aluminum[1]	Copper[2]
SR3-48 and HSR3-48	8	800A CU 600A AL[3]	600A	800A	800A	1200A MCB	1600A MCB
						1600A ML	2000A ML
SR3-24 and HSR3-24	6	400A	600A	800A	800A	N/A	N/A
SR3-12 and HSR3-12	2	200A	300A	400A	400A	N/A	N/A
SR3-6	0	100A	150A	N/A	N/A	N/A	N/A

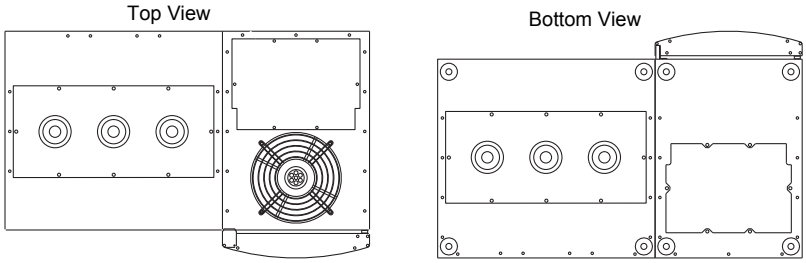
[1]Must use copper feeds when using 100% rated breakers and breakers rated greater than 1200A

[2]Aluminum feeds suitable for 80% rated breakers at 1200A and less, and main lugs 1600A and less.

[3]SR 48 is rated at 600A for aluminum feeds

Attaching Line and Load Wire Conduit

Aux Bay access panels have conduit knockouts for installing conduit.



Knockout sizes		
Size	Conduit	Hole size
Large	2 inch	2.5 inch
Medium	1.5 inch	2.0 inch
Small	0.75 inch	0.9 inch

Figure 27: Aux Bay wire access

Step 1: Remove the desired access panel from the rack.

Step 2: Punch out the desired knockouts (consult the table in *Figure 27* for knockout sizes) or cut access holes in the top and bottom access panels.

Note: *19 inch Aux Bays (Figure 27) have three conduit knockouts per panel. 30 inch Aux Bay panels have five conduit knockouts.*

Step 3: Install your conduit fittings into the holes.

Step 4: Re-install the access panel.

Using a Wire Trough for Line and Load Wire Access

Step 1: Remove the access panel.

Step 2: Create the desired openings in the access panel by removing conduit knockout or cutting openings and reinstall the panel.

Step 3: Install a fiche paper lining or grommeting material in the access panel opening.

Note: *Wire openings must have fittings or linings to protect wire and cable insulation from damage by sharp metal edges.*

Step 4: Position the wire trough above the prepared opening.

Connecting the Aux Bay Line Feed Wires

Line feed wires are terminated on the bay's line phase, neutral and ground lugs. Phase and neutral lugs are located on bus bars. The ground lug is shipped attached installed in the Aux Bay cabinet.

Aux Bay bus bars ship with one, dual hole lug but can accommodate additional lugs depending on whether the bars are single (left or right) or dual side connectors. Work with your ETC representative for system requirements.

Step 1: Install the connection lugs on the phase and neutral bus bars. Lugs can be installed in up or down position as desired.

Note: *Install lugs so the entire back of the lug makes contact with the bus bar. This creates the best electrical contact.*

Step 2: Pull the line phase, neutral and ground cables to the rack to their respective lugs.

Step 3: Strip 1 inch of insulation from the end of the line phase, neutral and ground cables and attach them to the correct lugs. *Line connections are labeled **A**, **B**, **C**, **N**, and **Equipment Grounding Lug**.*

Note: *The example in Figure 28 shows a three phase 48 module Aux Bay. Single phase Aux Bays (only available for the 12 and 24 module racks) are shipped with two phase bus bars labeled **L1**and **L2**.*

Step 4: Tighten the lugs to the correct torque based on cable size.

- AU 250–Two 250 kcmil cables (max.), 5/16 inch hex (Allen) lug driver
- AU 350–Two 350 kcmil cables (max.), 3/8 inch hex (Allen) lug driver
- AU 600–Two 600 kcmil cables (max.), 1/2 inch hex (Allen) lug driver

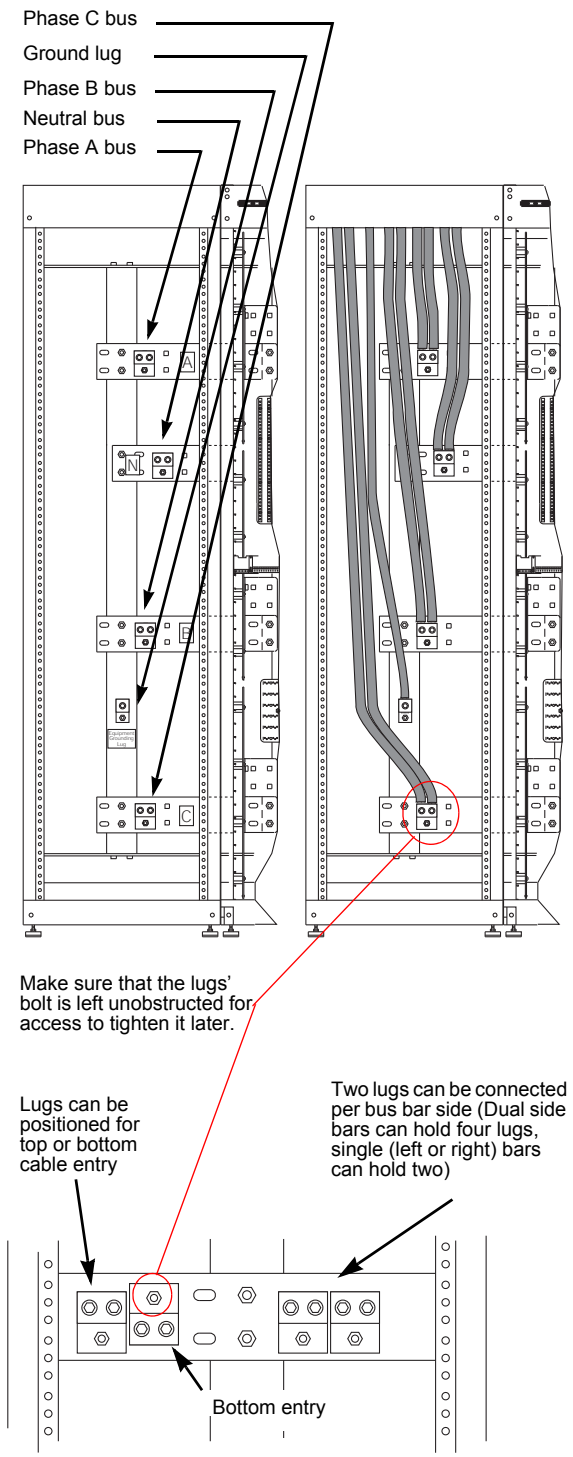

Phase C bus
Ground lug
Phase B bus
Neutral bus
Phase A bus
Make sure that the lugs' bolt is left unobstructed for access to tighten it later.
Lugs can be positioned for top or bottom cable entry
Two lugs can be connected per bus bar side (Dual side bars can hold four lugs, single (left or right) bars can hold two)
Bottom entry

Figure 28: Aux Bay dual bus bar detail (dual bar shown)

Note: *If a custom lug is used to connect line cables, follow the lug manufacturer's torque recommendations.*

Table 4: Line lug torque

Cable size	Torque (inch lbs.)	Torque (foot lbs.)	Torque (N-m)
4 – 6 AWG	110 lb-in.	9.2 lb-ft.	12 N-m
1 – 2 AWG	150 lb-in.	12.5 lb-ft.	17 N-m
1/0 – 2/0 AWG	180 lb-in.	15 lb-ft.	20 N-m
3/0 – 4/0 AWG	250 lb-in.	20.8 lb-ft.	28 N-m
250 – 450 kcmil	325 lb-in.	27.1 lb-ft.	36.5 N-m
500 – 750 kcmil	375 lb-in.	31.3 lb-ft.	42.5 N-m

Step 5: Tighten the lug fasteners using the values in on the Torque Values sticker on the bottom of the installation racks, or see *Table 3 on page 17*.

Connecting Line Power Directly to Bussed Dimmer Racks

If the bussed rack assembly does not include an Auxiliary Bay, line connections are made to one rack.

Note: *Copper and aluminum are both acceptable for line and load wiring but have restrictions. Reference the Dimmer Rack and Aux Bay Ratings, page 29 before installation to ensure your system does not void UL.*

This is done in the same manner as standard racks. Please see *Connect Line Power Wiring, page 11*.

Connecting the Line Feed Cables

Line feed cables are terminated on the rack's line phase, neutral and ground lugs. Phase, neutral and ground lugs are located the bus bars.

Step 1: If necessary, install phase lugs on the connection rack bus bars. Use the procedure in *Connecting the Aux Bay Line Feed Wires, page 31*.

Note: *Bussed racks with direct power connections are normally shipped with phase lugs installed on the connection rack's bus bars. If installation of custom lugs is desired, follow lug manufacturer's installation recommendations.*

Note: *Pull the line phase, neutral and ground cables to the rack through the openings you prepared previously. (See Using a Wire Trough for Line Power Wire Access, page 12.)*

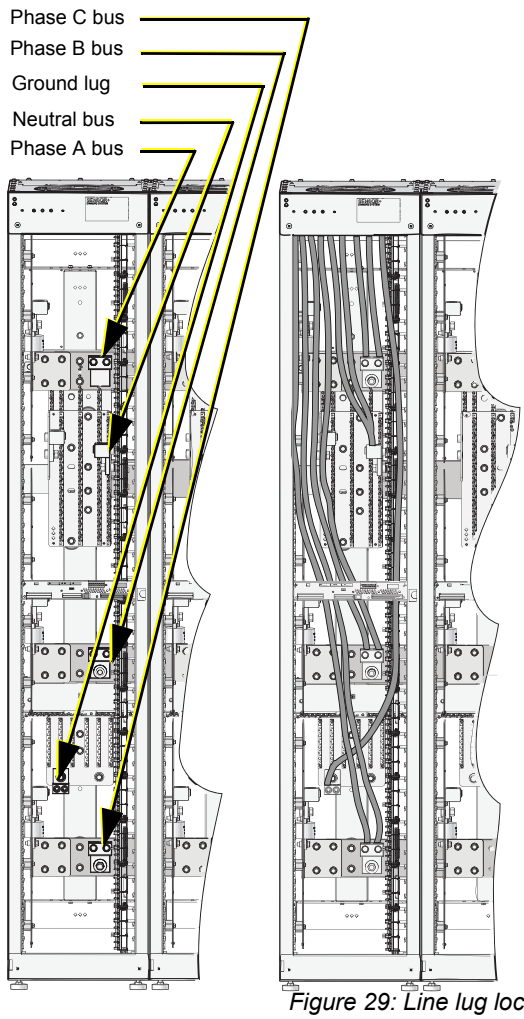


Figure 29: Line lug locations

Note: *Phase, neutral and ground lug orientation is reversible to make top or bottom connections easier. Lugs are shipped in top entry orientation.* ***Be sure to leave access to the lugs' bolt for tightening later.***

Step 2: Cut each cable so it reaches the desired lug without any excess. Line cables must be dressed neatly, with a minimum of excess wire.

CAUTION: *Dress wires neatly and avoid leaving extra wire inside the rack. Too much clutter (especially along the right side of the rack) can restrict air circulation and reduce cooling efficiency. If cabling interferes with airflow during operation, the rack may shut down due to overheating.*

Step 3: Strip 1 inch of insulation from the end of the line phase, neutral and ground cables and attach them to the correct lugs. Each phase is labeled either **A**, **B**, **C**, **N**, and **Equipment Grounding Lug**. Labels are attached to the phase, neutral and ground distribution plates, not to the bus bars.

Note: *The example in Figure 29 shows a three phase 48 module rack. Single phase racks (only available for the 12 module and 24 module racks) are shipped with two phase bus bars labeled **L1**and **L2**.*

Step 4: Tighten the lugs to the correct torque based on cable size.

- AU 250–Two 250 kcmil cables (max.), 5/16 inch hex (Allen) lug driver
- AU 350–Two 350 kcmil cables (max.), 3/8 inch hex (Allen) lug driver
- AU 600–Two 600 kcmil cables (max.), 1/2 inch hex (Allen) lug driver

Note: *If a custom lug is used to connect line cables, follow the lug manufacturer's torque recommendations.*

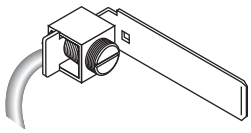
Table 5: Line lug torque

Cable size	Torque (inch lb.)	Torque (foot lb.)	Torque N-m
4 – 6 AWG	110 lb-in.	9.2 lb-ft.	12 N-m
1 – 2 AWG	150 lb-in.	12.5 lb-ft.	17 N-m
1/0 – 2/0 AWG	180 lb-in.	15 lb-ft.	20 N-m
3/0 – 4/0 AWG	250 lb-in.	20.8 lb-ft.	28 N-m
250 – 450 kcmil	325 lb-in.	27.1 lb-ft.	36.5 N-m
500 – 750 kcmil	375 lb-in.	31.3 lb-ft.	42.5 N-m

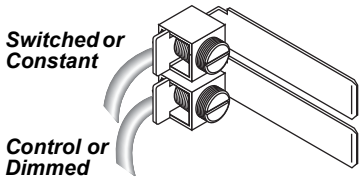
Chapter 4
Land Load Wires

Load lugs are on the right side of the rack. Lugs can be single 15/20 amp, paired 15/20 amp fluorescent, double-height 50 amp, or dual-slot 100 amp.

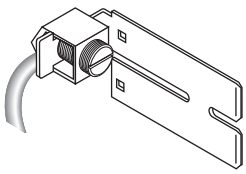
Note: *Do not terminate more than one conductor per lug.*



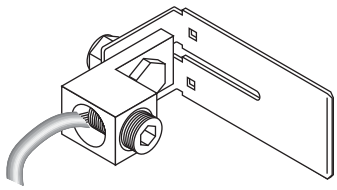
15/20 amp lug



Dual 15/20 amp lugs (fluorescent)



Double-height 50 amp lug



Dual slot 100 amp lug

Figure 31: Load lug types

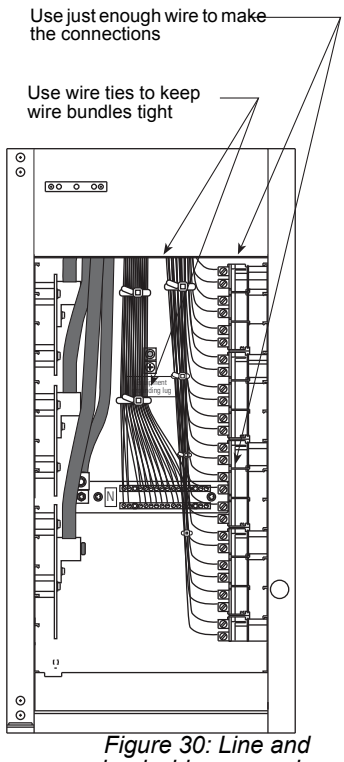


Figure 30: Line and load wiring example

Note: *When using D20F modules connected to dimmable fluorescent 3-wire ballasts, wire the top lug in each slot to the ballast's non-dimmed power lead and the bottom lug to the dimmed ballast control lead.*

When using D20FB modules connected to dimmable fluorescent 2-wire ballasts with integral battery back up, use the same terminations as listed above for 3-wire ballasts.

CAUTION: *Dress and terminate wires neatly and avoid leaving extra wire inside the rack. Too much clutter (especially along the right side of the rack) can restrict air circulation and reduce cooling efficiency. If cabling interferes with airflow during operation, the rack may shut down due to overheating.*

Load wires should not cross between racks. They should enter the rack in which they will be terminated.

Hot and neutral load wiring must follow the same conduit/path for each circuit.

Step 1: Route the load wires to the rack(s).

Note: *The Discrete Neutral bussing used by Ground Fault Interrupt racks have different load wire connection requirements. See Connecting Ground Fault Circuit Interrupt Racks (120V GFCI), page 38 for more information.*

CAUTION: *A two-wire circuit with **separate hot and neutral conductors is required** for every branch circuit that will be connected to the dimmer rack. Shared neutral (multiwire) branch circuit arrangements are not recommended for phase-control dimming systems due to harmonics and potentially elevated neutral currents in a shared neutral arrangement.*

For retrofit installations where shared neutral circuits are already installed, or track lighting installations where the track has a shared neutral, consult ETC Technical Services for rack installation guidelines.

Step 2: Combine load ground wires into the Equipment grounding lug and torque to the recommended value from *Figure 6*, above.

Note: *Use the combined diameter of the ground wires to determine the torque needed. If there are too many load ground wires to fit into the equipment grounding lug, replace it with a larger lug or bus and torque to manufacturer's specification.*

It is acceptable to land multiple ground wires in the same lug.

Step 3: Separate the neutral load wires from the other cables, route them to the neutral bus in each rack, and terminate them.

Step 4: Route each hot load wire to its individual load output connection.

CAUTION: *To prevent interference with cooling airflow, do not run load wires from one rack through a different rack. See Sealing Rack Air Leaks, page 40 for more information.*

- 15 – 50 amp load lugs
  Insert the wire under the pressure plate and tighten it onto the wire with the screw. Do not clamp the wire directly under the screw.

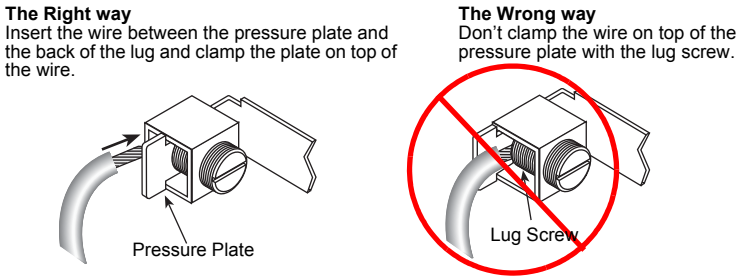

The Right way
Insert the wire between the pressure plate and the back of the lug and clamp the plate on top of the wire.
The Wrong way
Don't clamp the wire on top of the pressure plate with the lug screw.
Pressure Plate
Lug Screw

Figure 32: Connecting 15 – 50 amp load lug wires

- 100 amp load lugs tighten the screw lug directly on the cable (see *Figure 31*).

Step 5: Tighten all load connections to the torque specified in the table below.

Table 6: Line lug torque

Connection	Cable size	Torque	Torque	Torque
20 to 50 amp and fluorescent Load lugs	14 to 10 AWG (1.5-6mm^2) 8 AWG (8-10mm^2) 4 to 6 AWG (16mm^2)	35 lb-in. 40 lb-in. 45 lb-in.	2.9 lb-ft. 3.3 lb-ft. 3.8 lb-ft.	4 N-m 4.5 N-m 5 N-m
100 amp Load lugs	14 to 8 AWG (1.5-10mm^2) 6 to 4 AWG 16-25mm^2) 2 to 1 AWG (35-50mm^2) 1/0 to 2/0 (70mm^2)	75 lb-in. 110 lb-in. 150 lb-in. 180 lb-in.	6.3 lb-ft. 9.2 lb-ft. 12.5 lb-ft. 15 lb-ft.	8.5 N-m 12 N-m 17 N-m 20 N-m
Neutral bus	14 to 8 AWG (1.5-10mm^2)	25 lb-in.	2 lb-ft.	3 N-m
Equipment grounding	14 to 8 AWG (1.5-10mm^2) 4 to 6 AWG (16-25mm^2) 2 to 3 AWG (35mm^2)	75 lb-in. 110 lb-in. 150 lb-in.	6.3 lb-ft. 9.2 lb-ft. 12.5 lb-ft.	8.5 N-m 12 N-m 17 N-m

Connecting Ground Fault Circuit Interrupt Racks (120V GFCI)

Sensor3 GFCI racks have discrete Neutral bussing for using GFCI dimmer modules, which provide extra safeguards in hazardous environments.

CAUTION: *GFCI protection does not increase sensitivity to overcurrent conditions caused by shorts between a circuit's neutral and load wires. Overcurrent protection, provided by the dimmer module circuit breaker, is identical to equally rated standard Sensor3 dimmer modules.*

Note: *GFCI rack slots can be modified to use standard Sensor3 dimmer modules. For information on converting module slots from GFCI to standard, see Appendix B: Converting Discrete Neutral Dimmer Lugs, page 45. Converted slots have the same discrete Load Neutral wire connections as GFCI slots.*

Making Discrete Neutral Load Connections

GFCI racks have a larger line Neutral bus, with individual Load Neutral lugs for each dimmer circuit. Neutral and Hot wires from GFCI circuits must be matched to the same GFCI dimmer to work correctly.

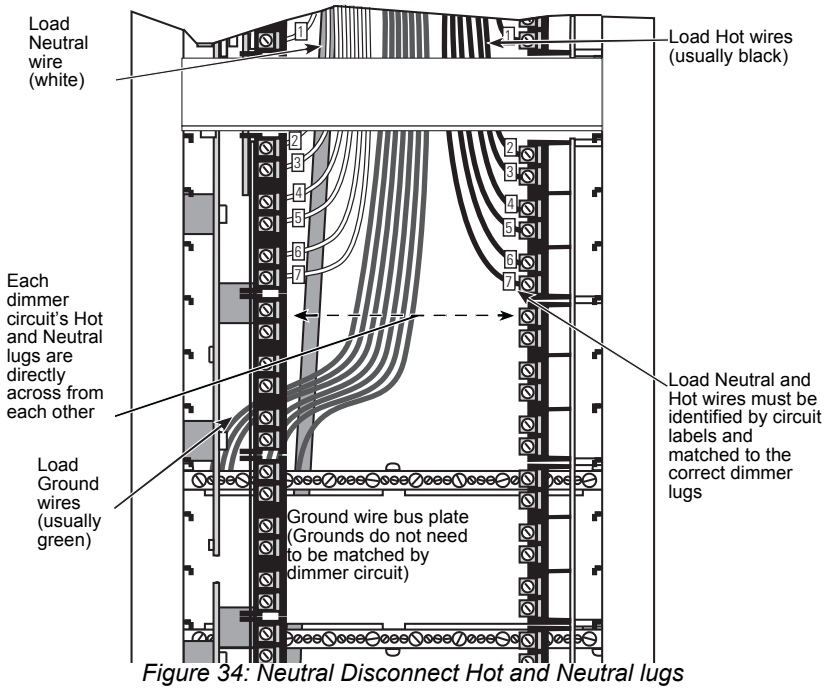

Load Neutral wire (white)
Load Hot wires (usually black)
Each dimmer circuit's Hot and Neutral lugs are directly across from each other
Load Neutral and Hot wires must be identified by circuit labels and matched to the correct dimmer lugs
Load Ground wires (usually green)
Ground wire bus plate (Grounds do not need to be matched by dimmer circuit)

Figure 34: Neutral Disconnect Hot and Neutral lugs

Step 1: Follow the instructions in *Connect Line Feed Cable, page 13*, to prepare line cables for connection.

Step 2: Follow the instructions in *Connect Line Feed Cable, page 13,* to connect line cables to the rack. Use *Figure 33* to locate line connections.

WARNING: ***A Ground Fault Circuit Interrupt load circuit will not function unless its Hot and Neutral wires are connected to the same dimmer and run in the same conduit/wire path.***

Step 3: Follow the instructions in *Load lugs are on the right side of the rack. Lugs can be single 15/20 amp, paired 15/20 amp fluorescent, double-height 50 amp, or dual-slot 100 amp., page 36,* to connect load wires to the rack. Refer to *Figure 34* to locate Ground Fault Circuit Interrupt load wire connections.

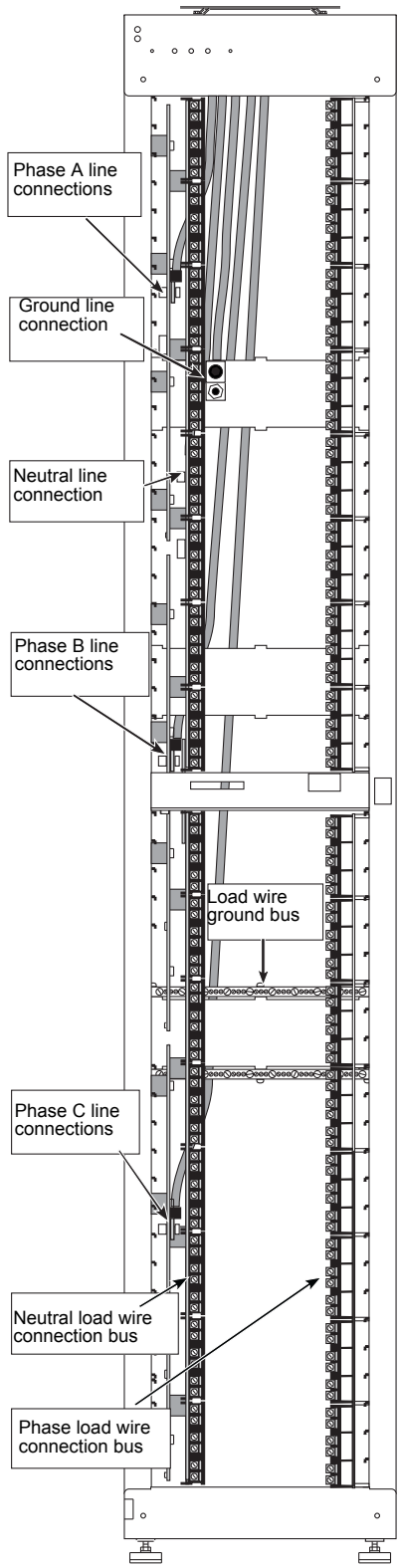

Phase A line connections
Ground line connection
Neutral line connection
Phase B line connections
Load wire ground bus
Phase C line connections
Neutral load wire connection bus
Phase load wire connection bus

Figure 33: Ground Fault Interrupt line and load connections

Chapter 5
Finishing Installation

Sealing Rack Air Leaks

After you have attached all the conduit to the rack and connected all wiring, you must seal any air leaks in the rack cabinet created during the installation process. Use urethane aerosol foam or conduit duct seal to fill air gaps in conduit.

Step 1: Seal all conduit access holes.

Step 2: Re-install access panels removed during installation, or completely cover their openings with fiche paper and urethane aerosol foam or duct seal.

Step 3: Seal any air gaps caused by bent access panels.

Step 4: Fill in any gaps inside partially filled wiring conduit.

Step 5: Fill in other gaps or holes in the cabinet created during installation.

Step 6: Any racks that are installed side-by-side (bolted together) should only have minimal airflow between them.

- Bussed racks shipped from ETC should have the proper baffling in place. **Check to make sure it hasn't moved during shipping or installation.**
- Racks that are bussed in the field need to have the airflow between the racks restricted to a minimum.

CAUTION: *Air leaks can cause dimmer racks to overheat during operation and shut down. Air leaks can also cause a rack to shut down via an "Airflow Error" meaning that too little air is going through the front of the rack where it is needed to cool the dimmers.*

Attaching the door

All Sensor3 racks (except the SR3-6) are delivered with the doors separated. This improves access to the rack interior for wiring and other installation work. Some loose door installation parts are bundled with the doors as detailed below in Table 7.

When interior wiring is completed, attach the rack door. Do not operate your dimmer rack without a door installed.

Table 7: Loose parts shipped with Sensor3 rack doors

12 Module Qty	24 Module Qty	48 Module Qty	ETC Part Number	Descriptions
1	1	1	7051A4116	Acrylic door beacon
2	2	1	7051A3006	Bracket, Rack door hinge
-	-	1	7051A2009	48 module Bottom hinge
4	4	2	HW486	Screw 10-32x½ PhTHMS
2	2	2	HW253	Screw 6-32x3/8 truss SS
3	3	3	HW757	Pin, Taper 5/32x1.0
6	6	6	HW327	Washer, Flat #8.188x.375x.049 SS
1	1	1	HW8146	Keylatch with Keeper 93-10-202-50

Note: *SR3-6 racks ship with their doors assembled and attached.*

CAUTION: *Dimmer rack doors filter and regulate ventilation airflow. Operating without the door can contaminate the rack interior with dust and cause rack modules to overheat.*

Step 1: Insert the top hinge into the slot on the top of the rack and attach it to the frame with two 10-32 x 1/2 inch Phillips head screws (included).

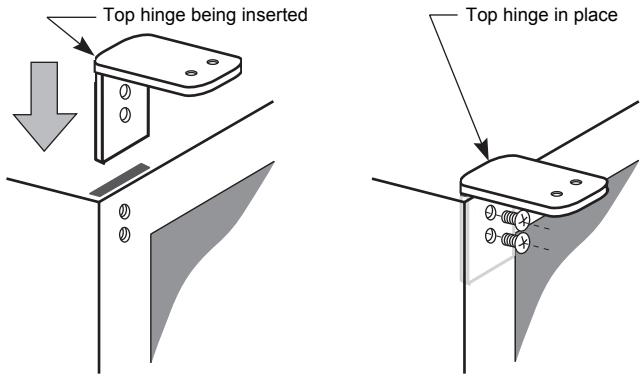


Figure 35: Attaching the top door hinge

Step 2: The bottom hinge on the 48 module rack is a different design from the one used on the smaller racks to compensate for the heavier door.

- 12 and 24 module rack – Insert the bottom hinge into the slot on the bottom of the rack and attach it to the frame with two 10-32 x 1/2 inch Phillips head screws (included).

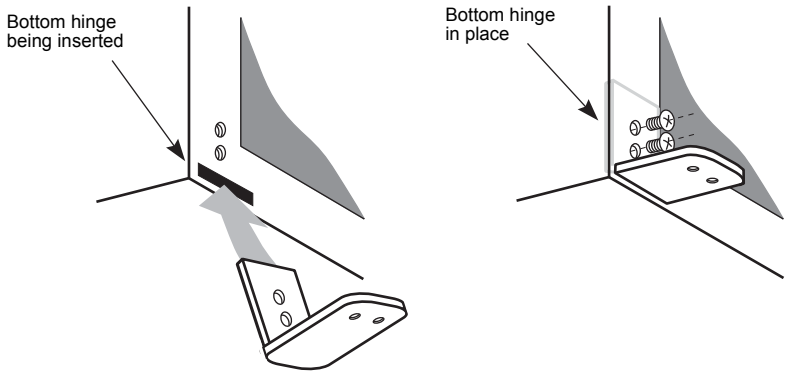


Figure 36: Attaching the 12 and 24 module rack bottom hinge

- 48 module rack – Remove the 10-32 x 1/2 inch Phillips head screw, insert the hinge into the slot and secure it by replacing the screw.

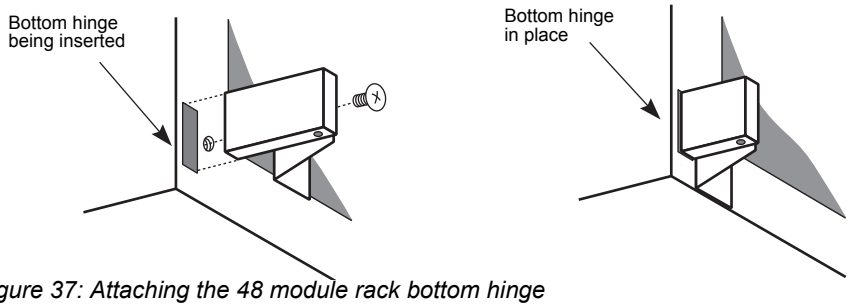


Figure 37: Attaching the 48 module rack bottom hinge

- Drive the narrow end of one taper pin into the bottom of the door. Put the taper pin through the washers and into the hole on the lower hinge.

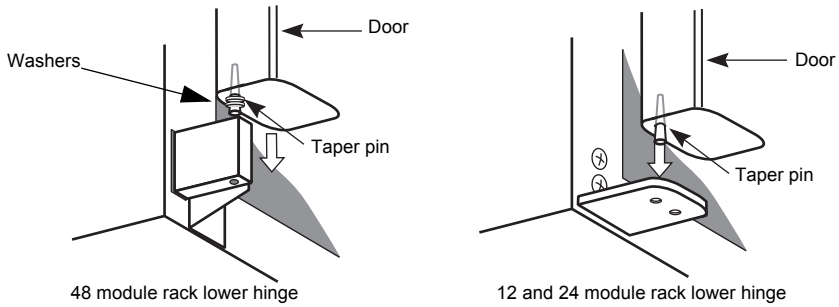


Figure 38: Installing the bottom taper pin

Step 3: Hold the door in place and insert the other taper pin, narrow end down, through the top hinge and washer.

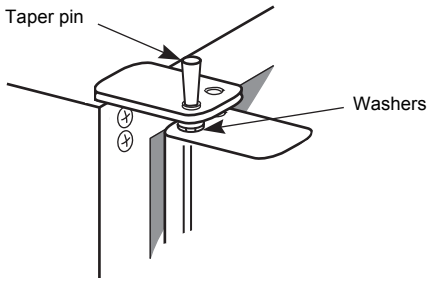


Figure 39: Installing the top taper pin

Step 4: Take the Sensor3 beacon block, insert it through the slot on the upper left corner of the door and secure it with two 10-32 x 1/2 inch Phillips head screws (included).

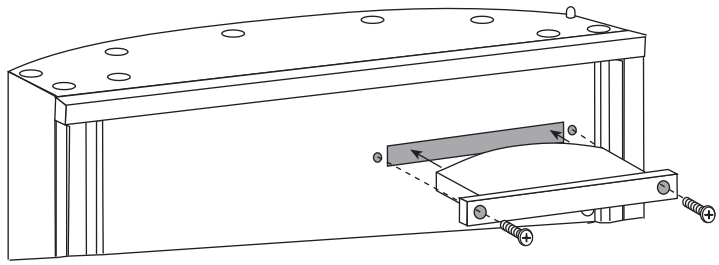


Figure 40: Installing the beacon block

Appendix A

Check Power Installation

It is a good idea to review the installation before applying power to the rack.

WARNING: ***Power must be turned OFF when you perform this procedure. Before removing dimmer or control modules for service, de-energize main feed to dimmer rack and follow appropriate Lockout/Tagout procedures as described in NFPA Standard 70E. It is important to note that electrical equipment such as dimmer racks can present an arc flash safety hazard if improperly serviced. This is due to available large short circuit currents on the feeders of the equipment. Any work on energized equipment must comply with OSHA Electrical Safe Working Practices.***

Step 1: Clean out dust, metal scraps or other debris from the rack interior.

Note: *ETC recommends vacuuming the rack interior after the installation of the wiring.*

Step 2: Check for loose connections, bare wires or damaged insulation.

Step 3: Spin the top cooling fan in both directions to be sure it is not obstructed. Correct/stop air leaks left in conduit openings, empty screw holes or misaligned panels.

Checking Main Power Wiring

Check resistance between phases, neutral and ground busses with a digital voltmeter (DVM):

- **Phase to phase**; resistance should be 10M Ohm or higher
- **Phases to ground**; resistance should be 10M Ohm or higher
- **Neutral to ground**; resistance should be 0 Ohm
- **Phase to neutral**; resistance should be 10M Ohm or higher

Checking Load Wiring

Check resistance between the load terminals and the neutral buss:

- Above 1M Ohm – Normal when no load is connected
- Between 1 – 1000 Ohm – Normal when loads are connected
- Below 1 Ohm – Indicates a dead short in the load wiring

WARNING: ***A dead short can cause dimmer module damage.***

Appendix B

Converting Discrete Neutral Dimmer Lugs

If you need to place a non-GFCI protected circuit and use a non-GFCI dimmer module (such as a standard D20) in a GFCI rack, you need to perform this conversion. This conversion needs to be done per slot to accommodate an entire module. ETC does not make a module that is half GFCI and half standard.

Converting GFCI dimmer slots

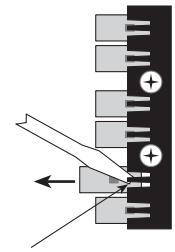
Step 1: Shut off rack power at the main circuit breaker.

WARNING: ***Servicing a dimmer rack with power on may result in death or injury from electrical shock. Before removing dimmer or control modules for service, de-energize main feed to dimmer rack and follow appropriate Lockout/ Tagout procedures as described in NFPA Standard 70E. It is important to note that electrical equipment such as dimmer racks can present an arc flash safety hazard if improperly serviced. This is due to available large short circuit currents on the feeders of the equipment. Any work on energized equipment must comply with OSHA Electrical Safe Working Practices.***

Step 2: Determine which dimmer slots you will be converting. You can convert either individual slots or a three-slot strip at a time.

Step 3: Gently bend the neutral lug retraining tab out with a small standard screwdriver until the lug releases and you are able to pull it out. See *Figure 41*.

CAUTION: *Lug catches will break if bent too far. Only bend the catch until the lug releases.*



Use a small flat screwdriver to lift the lug tab enough to release the lug from the strip and pull it out.

Figure 41: Removing a lug

Step 4: Use a #2 flat screwdriver to loosen the threaded inserts until the contact plates can slide out of both lugs.

Step 5: Repeat *Step 3* and *Step 4* for the other dimmer slot lug.

Step 6: Install a Neutral lug jumper into the lugs and tighten the threaded inserts.

Step 7: Slide the jumpers into the plastic lug strip until the lug tab clicks into place.

Step 8: Secure the jumper to the PEM insert on the main Neutral bus using the provided 4-40 screw.

Step 9: Repeat Steps 1 through 6 for any other lugs you want to convert.

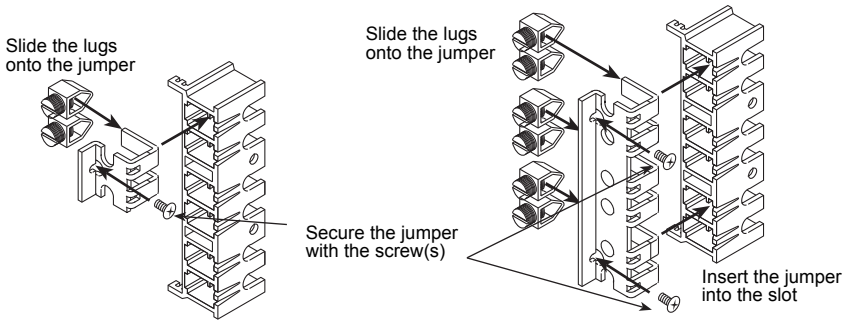


Figure 42: Converting Neutral Disconnect lugs to use standard dimmers

Installing Three-Slot Dimmer Lug Strips

Step 1: Use a #2 Phillips screwdriver to remove the two 4-40 screws securing the lug strip to the left side of the rack.

Step 2: Remove the lug strip and replace it with one containing a three-slot Neutral jumper.

Step 3: Secure the strip to the rack with the screws you removed in Step 1.

Step 4: Secure the jumper to the main Neutral bus PEM inserts using the two 4-40 screws provided with the jumper strip.

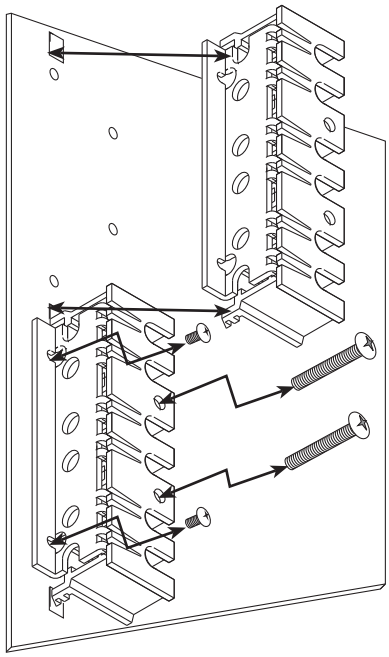


Figure 43: Removing or installing a Neutral lug strip

Appendix C

120V GFCI Circuit Troubleshooting

Ground Fault Circuit Interrupt (GFCI) circuits provide extra protection for people and equipment by comparing current on the Hot (supply) and Neutral (return) wires of each dimmer circuit. In a properly functioning circuit, the current on these wires will be equal, because all the current carried to the loads by the hot wire returns on the Neutral wire to complete the circuit.

In the event of a ground fault, some or all of the current “leaks” from the circuit to ground. This leakage reduces the amount of current that returns on the neutral wire. The GFCI electronics detect this difference and trip the circuit breaker.

Requirements for GFCI circuits

- GFCI circuit wires cannot be longer than 125 feet (measured from dimmer lugs)
- The neutral and hot wires for each GFCI protected circuit must run in the same dedicated conduit.
- No splitting of load and neutral wires between conduits
- No ganging of neutral (return) wires at any point in circuit
- No including non-GFCI load or neutrals in GFCI conduits
- Low voltage loads need special transformer or GFCI won't trip on fault
- GFCI compatible fluorescent ballasts must be used

Typical causes of GFCI circuit faults

Circuit immediately trips when powered up

- Load and neutral wires from different circuits are connected to GFCI dimmer
- Neutral wires are ganged with other dissimilar loads
- There is a real GFCI circuit fault

Circuit intermittently trips when powered up

- Load and neutral wires from different (but associated) circuits are connected to GFCI dimmer
- Neutral wires are ganged with associated dimmer circuits
- There is an intermittent GFCI circuit fault

Circuit does not trip during a GFCI fault

- GFCI dimmer is connected to the wrong (fault-free) dimmer circuit
- GFCI circuit load is an incompatible low-voltage transformer or fluorescent ballast type
- GFCI dimmer module is faulty

WARNING: ***GFCI dimmer modules cannot be repaired on site. Defective modules must be replaced and returned to ETC for evaluation or repair. Do not allow anyone to attempt to repair a GFCI module in the field. A GFCI module that has been tampered with does not provide UL 943-compliant GFCI circuit protection.***

Appendix D
Sensor3 Rack Specifications

All of the rack specifications apply to all of the SR3 series of racks unless otherwise noted.

General

Racks available in four sizes

- SR3-6 — 6 modules, 12 dimmers maximum
- SR3-12 and HSR3-12 — 12 modules, 24 dimmers maximum
- SR3-24 and HSR3-24 — 24 modules, 48 dimmers maximum
- SR3-48 and HSR3-48 — 48 modules, 96 dimmers maximum

Dual density (two dimmers per module), single density and half density dimmer modules available

Environmental

Operating temperature: 0° to 40°C (32° to 104°F)

Dimmer room HVAC systems must at all times maintain the specified ambient temperature at the dimmer rack. Dimming systems operating within 10 degrees F of the upper or lower temperature limits must strictly follow installation and operation guidelines to operate reliably.

Relative humidity: 10 to 90% non-condensing

GFCI Load Wiring Requirements

Up to 125 foot load wire length

Can use standard load wiring, type XHHW recommended

Load and neutral wires for each circuit installed in same conduit

No ganging of neutral (return) wires at any point

GFCI Restrictions

GFCI modules do not support ETC's Dimmer Doubling

GFCI modules may not detect ground faults across a transformer

Contact ETC for applications requiring longer branch circuit runs or non-resistive loads such as motors or electronic/ magnetic ballasts

Mechanical

Rugged 16-gauge steel construction

Fine-textured, scratch-resistant, epoxy paint

6 and 12 module racks use wall mount installation

24 module racks can be wall or pedestal mounted

48 module racks are floor mounted

Top and bottom conduit access through removable panels (48 module racks) or knockouts (6, 12, and 24 module racks)

No tools required for module removal or installation

Keyed module slots prevent insertion of inappropriate module types

Front access to all wiring and terminations

Full height locking door

Electrostatic air filter easily removed from door for periodic cleaning

High efficiency cooling system with airflow sensor

High visibility LED status beacon

Electrical

See *Dimmer Rack and Aux Bay Ratings, page 52* for specifics on rack feeder amperage.

SR3 series line feed voltage range is 91 to 139 VAC

HSR3 series line feed voltage range 190 to 265 VAC

6, 12, and 24 module 120 V SR3 racks accept:

- Three phase 120/208 VAC
- Single phase 120/240 VAC

48 module rack accepts:

- Three phase 120/208 VAC
- Single phase 120/240 VAC up to 600 amps

Line feed frequencies from 47 to 63 Hz

Maximum current ratings: 3 phase

- SR3-6 – 100 amps per phase
- SR3-12 and HSR3-12 – 200 amps per phase
- SR3-24 and HSR3-24 – 400 amps per phase
- SR3-48 and HSR3-48 – 800 amps per phase
- SR3-48 and HSR3-48 with Aux Bay- 2000 amps per phase (3 phase max). 1600 amps max with main breaker.

Maximum current ratings: Single phase

- SR3-6 – 150 amps per phase
- SR3-12 and HSR3-12 – 300 amps per phase
- SR3-24 and HSR3-24 – 600 amps per phase
- SR3-48 and HSR3-48 – 600 amps per phase

See *Dimmer Rack and Aux Bay Ratings, page 52* for limitations when using aluminum and copper feeders.

Load terminals accept up to #4 AWG (16mm^2) wire (see chart)

100,000 SCCR symmetrical rack rating at 120V

10,000 SCCR symmetrical at 240V

Auxiliary Equipment Racks and switchgear/distribution available (Call ETC for details)

All racks UL and cUL Listed

SR3AFN racks: UL and cUL 943 compliant Class A 120V GFCI devices

UL File # E92134

Control

Sensor3 Control Electronics Module (CEM3) electronics

Hardware rear — Ethernet control signal input

Front Cat5 Ethernet uplink to the Net3 Lighting network — Two DMX512 inputs

USB quick load

Supports Dimmer Doubling™ in 120V systems.

Web Interface — Allows remote users to browse into the power control system to activate locally set levels, check circuit and rack status, and perform adjustments to mode settings.

Options

Advanced Features™ dimmer-specific load and diagnostic reporting (included with SRA3F and SRA3FN racks)

Amp-Trap® fuses to allow feeding individual racks from oversize mains

All-copper bus kits available

Auxiliary Racks

Vibration reduction kits available for all racks

Empty Rack Weights

SR3- and HSR3- Models	Weight	
	lbs.	kgs.
6	36.0	16.0
12	45.0	21.0
12 Door*	11.0	5.0
24	107.0	49.0
24 Door*	17.0	8.0
48	188.0	86.0
S48 Door*	31.0	14.0

*Rack doors ship separately

Note: Installed rack weights are dependent upon number and type of installed modules. To calculate approximate installed weight, multiply the module weight times the number of modules, add the result with the CEM3 weight, and the above weights for rack and door. Final weight will also include weight of installed line and load wiring.

Maximum - D20DHR modules (5.7lbs/2.6kg per slot)

Typical - D20 and HD15 or 20 modules (5.0 lbs/2.3kg per slot)

Refer to module data sheets to calculate total module weight for other module types.

Wiring Charts

Primary Feed Lug Capacity

SR3- and HSR3- Models	Wire Size	Wire Size
6	Single 2/0 to 14 AWG	2mm^2 to 60mm^2
12	Dual 250 kcmil to 6 AWG	15mm^2 to dual 125mm^2
24	Dual 350 kcmil to 4 AWG	25mm^2 to dual 170mm^2
48	Dual 600 kcmil to 2 AWG	35mm^2 to dual 300mm^2

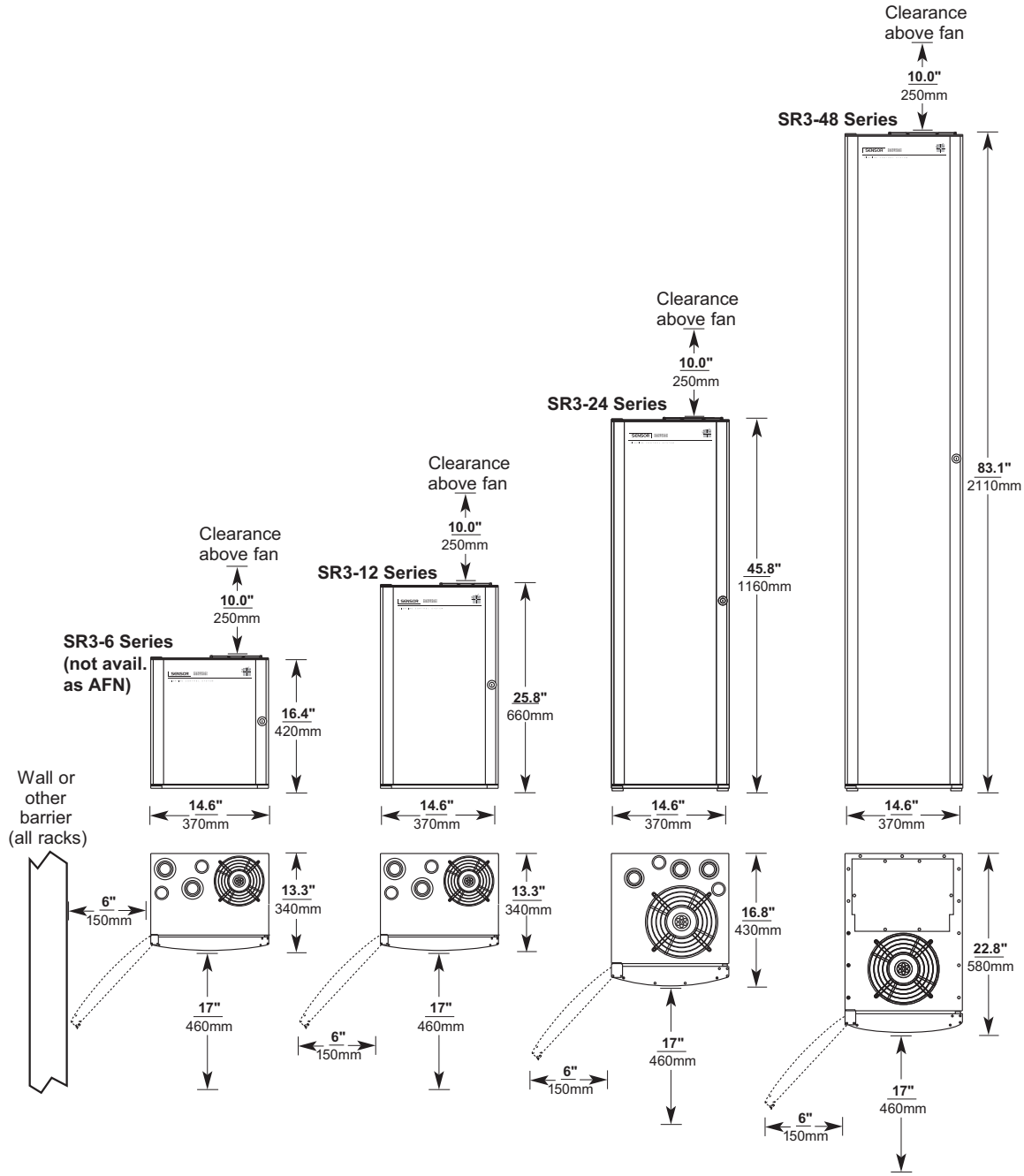
Load Wiring Lug Capacity

Connection	Wire Size
10A, 15A, 20A and 50A lugs	4 AWG Max. (16mm^2)
100A lugs	2/0 Max (60mm^2)

Rack Dimensions

Installation Rack Dimensions

SR3- and HSR3- Models	Height		Width		Depth	
	inches	cm	inches	cm	inches	cm
6	16.4	42	14.6	37	13.3	34
12	25.8	66	14.6	37	13.3	34
24	45.8	116	14.6	37	16.8	43
48	83.1	211	14.6	37	22.8	58



Dimmer Module Efficiency

The following table provides information on the thermal efficiency of ETC Sensor3 dimmer modules. All dimmer efficiencies are measured at maximum current (full load). Note that the watt and BTU figures shown below apply to single dimmers, not dimmer modules and a module often contains more than one dimmer.

Table 8: Dimmer Module Efficiency

Module Type	Dimmers per Module	Full Load in Watts	Watts Dissipated	BTUs Dissipated	Dimmer Efficiency%
CEM+/CEM3+	—	—	<4	<10	—
D15	2	1,800	56	190	96.9
D15AF, D15E	2	1,800	70	237	96.1
D20	2	2,400	77	261	96.8
D20AF, D20E	2	2,400	119	405	95.1
D20HR	1	2,400	259	883	89.2
D50AF	1	6,000	237	808	96.1
D50HR	1	6,000	543	1,853	90.9
D100AF	1	12,000	446	1,521	96.3
HD15	2	3,600	65	222	97.2
HD25	2	6,000	238	810	96.9

Although Sensor3 dimmers are designed to operate safely in environments with ambient temperatures of up to 104°F (40°C), as with all electronic equipment, keeping the operating environment at cooler temperatures will help improve the service life of the equipment. In order to maximize the efficiency of your dimming system, dimmer room air conditioning should maintain an ambient dimmer room temperature of 68°F (20°C) or less.

Note: *When calculating air conditioning requirements, keep in mind that the BTU outputs cited in the table above are **maximums**. The heat actually dissipated may be less depending on the size of the loads. Factors that influence actual heat dissipation include service ampacity, as well as how the dimmers are used and typical loads.*

Dimmer Rack and Aux Bay Ratings

Standard ETC Sensor Rack Options with Maximum Current Ratings

Dimmer Racks	Suggested Max # of bussed racks	Max Current Rating of 3Ø Rack	Max Current Rating of 1Ø Rack	Max Current Rating of 3Ø 19" Aux		Max Current Rating of 3Ø 30" Aux	
				Aluminum[1]	Copper[2]	Aluminum[1]	Copper[2]
SR3-48 and HSR3-48	8	800A CU 600A AL[3]	600A	800A	800A	1200A MCB	1600A MCB
						1600A ML	2000A ML
SR3-24 and HSR3-24	6	400A	600A	800A	800A	N/A	N/A
SR3-12 and HSR3-12	2	200A	300A	400A	400A	N/A	N/A
SR3-6	0	100A	150A	N/A	N/A	N/A	N/A

[1]Must use copper feeds when using 100% rated breakers and breakers rated greater than 1200A

[2]Aluminum feeds suitable for 80% rated breakers at 1200A and less, and main lugs 1600A and less.

[3]SR 48 is rated at 600A for aluminum feeds

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